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Revd H. J. Feilden

AN

ESSAY

UPON

TUNE.

By Mr. Maxwell

BEING AN ATTEMPT

To free the SCALE of MUSIC, and the TUNE of INSTRUMENTS, from Imperfection.

ILLUSTRATED WITH PLATES.

Il n'y a point des Erreurs dans la Nature.

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AN ESSAY UPON TUNE.

PART I.

Of the TUNE of the FIDDLE.

CHAP. I.

An introductory account of the ſcale of muſic.

TO pave the way for ſuch readers as are unacquainted with the ſcale of muſic, and to aſſiſt them to underſtand what follows, it ſeems neceſſary to premiſe, That the judgment of the ear, and the ſentiment of pleaſure or of offence from muſical ſound, depend upon a compariſon of the ſeveral degrees of it with one particular tone, either actually expreſſed, or tacitly underſtood to accompany them; which tone is called the *key-note:* and the degree of this judgment, and of this ſentiment, is the talent which is meant to be expreſſed, when it is ſaid one is poſſeſſed of a good or of a bad ear.

This key-note is not any particular fixed degree of acuteneſs or gravity: for any degree of tune that ſuits the compaſs of the voice or inſtrument, may be aſſumed as a key-note; the idea of which being impreſſed upon the mind, the reſt are all referred to it.

One cannot illuſtrate this better, than by calling to mind that *tool* the bag-pipe, where the great drone gives a continuation of the key-note through the whole. However diſguſting this may be, from the dullneſs of its monotony; yet, in the beſt performances, if the idea of the key-note be loſt, the connection of the tune is alſo loſt, although it is not often attended to, or diſtinctly perceived at all times.

Theory teaches, that to this key-note there belongs a ſyſtem of ſeven different degrees of tune, which, under the regulation of certain laws, can ſucceed to each other agreeably; and this is called *melody*: Or they may be joined in conſonance, not all at the ſame time, but in certain groups and ſucceſſions; and this is called *harmony*.

Perhaps nature can afford more; but theſe are all that have been expreſsly diſcovered and defined hitherto by muſicians, or that are acknowledged in compoſition and practice.

For although we can ſtretch greatly beyond this ſimple ſyſtem, either aſcending or deſcending; yet muſicians know, that this is only a repetition of the ſame order of degrees: becauſe the eighth note above the key-note, called its *octave*, although it be much acuter than the key-note, yet gives the ſame muſical idea with the key-note itſelf; and ſo does the eighth note, above or below any note of the ſyſtem, produce the ſame idea as do the notes themſelves reſpectively.

This may be exemplified, by ſuppoſing a ſong to be ſung in the ſame part by a man and woman. In this caſe, the woman's voice will be, in every note, a juſt octave higher than the man's voice, and yet they ſhall agree in expreſſing the ſame tune. And it is known, that when a ſong is carried higher or lower than the performing voice or inſtrument can reach, the performer may ſupply that defect, by ſtriking the tune of the notes he cannot reach, differently by octave. The tune will thus be preſerved the ſame, although the effect cannot be altogether ſo agreeable: owing, however, only to the jump, which breaks the ſmoothneſs of the progreſs of the muſic; but not at all to any alteration in the fundamental relation of the terms, or of the idea expreſſed by the muſic.

We muſt ſtill go a little further, and advertiſe the inquirer, that although it be true, as has been ſaid, that no more than ſeven degrees of tune do properly belong to any given key-note, yet there are two different ſcales, or rather two different orders, of theſe muſical degrees. To explain this, it muſt alſo be told, that the muſical degrees of aſcent, or of deſcent, from a given key-note, are by no means equal. They are of three different dimenſions, called *tone greater*, *tone leſſer*, and *ſemi-tone*. What theſe dimenſions are ſhall be afterwards ſhown.

Theſe ſcales ariſe from the key-note, in the following order aſcending.

MAJOR MODE.

Key	Tone greater	2d,	Tone leſſer	3d,	Semi-tone.	4th,	Tone greater	5th,	Tone leſſer	6th,	Tone greater	7th,	Semi-tone	Octave

MINOR MODE.

Key	Tone greater	2d,	Semi-tone	3d,	Tone leſſer	4th,	Tone greater	5th,	Semi-tone	6th,	Tone greater	7th,	Tone leſſer	Octave

Both theſe ſcales afford agreeable muſic: and the reaſon why the one is called the *major*, and the other the *minor* mode, is, becauſe the third ſtep of the former riſes from the key-note by two degrees, called *tone greater* and *tone leſſer;* which makes that third note acuter than the third note of the other mode, which riſes only by the *tone greater* and *ſemi-tone.*

The ſixth and ſeventh of the major mode are likewiſe acuter than thoſe natural to the minor, as will afterwards be better underſtood; although frequently the minor alſo admits of the ſharp ſixth and ſeventh, as compoſers know. But as this eſſay is confined to the conſideration of the tune of inſtruments, the reaſon needs not be here explained.

It is a matter of perfect indifference, what note of the ſcale of muſic commonly uſed is aſſumed as a key-note, provided from thence the other notes of that key be taken, by juſt intervals, as they ſtand in one or other of the orders of degrees mentioned, according as the muſic is deſigned to be of the greater or of the leſſer mode. And all muſicians, by general conſent, have agreed to aſſume the note diſtinguiſhed by the letter C, as the natural key-note of the greater mode; which being fixed, A is thereby determined to become the natural key-note of the leſſer mode, for reaſons which will afterwards appear.

In order to obtain variety, ſo eſſential to the purpoſes of muſical entertainment, it has been found neceſſary to contrive inſtruments ſo, that other notes may occaſionally be introduced as key-notes, as well as C or A.

The two modes of tune already deſcribed, being found by experience to have the only true relations among their degrees, that are agreeable to the ear; the new key-notes to be introduced ought to be provided alſo with ſets of notes, bearing truly tuneful relation to each of them. But difficulties, hitherto deemed inſuperable, have obſtructed the ſucceſs of all attempts to gain this end.

The inequality of the intervals between the notes of the natural ſcales of muſic, renders ſeveral of the notes prepared to ſuit one key unfit to be applied to another: and ſome of the differences being very ſmall, and hitherto it appearing impoſſible to adjuſt them, have been overlooked; while thoſe that are larger have been groſsly corrected by the inſertion of new degrees of tune, which cannot be perfectly adjuſted to one key without becoming offenſive to another. Hence muſicians have been forced to lay aſide the true quantities of the intervals of natural tune, overlooking the difference between the tone greater and the tone leſſer, and to adopt what they indiſcriminately call a *full tone*, in place of either the one or the other of theſe; while the *ſemi-tone*, ſo called, is conſidered by them as the juſt half of this groſs interval called a *full tone*, although the true elementary ſemitone is known to be greater than the half of the tone greater.

This is one capital ſource of error in all our inſtrumental performances; and the fault becomes plainly perceptible to an ordinary ear, if it has once, upon accurate trial, experienced the ſuperior effects of tune truly adjuſted.

The only palliation that has been applied, is an attempt to diminiſh theſe errors, by ſpreading them equally over the whole ſyſtem, ſo that the ear may be leſs ſhocked. And were it certain that this could be perfectly accompliſhed, the conſequence would be, that although the ear would never be ſhocked by groſs diſcord, yet it never would hear good concord. For, whatever capital performers upon the violin, and ſuch kind of inſtruments which are called perfect, may pretend, it ſeems not at all doubtful, that their beſt performances are far from being juſt, and that means will be found for convicting them of conſiderable and frequent error.

Beſides the accuracy of the pitch, the idea of perfect tune likewiſe implies in it that of pure ſound, free from all inequalities in the vibratory motions. But as this is not to be hoped for from inſtruments compoſed of ſuch imperfect materials as we have, all that is here meant by *perfect tune*, is the neareſt approach to it that can be made upon ſuch an inſtrument as the fiddle; the conſtitution of which affords ſcope for attaining to it, as near as the imperfections of our ſounds will allow: and in this laſt ſenſe only it muſt be underſtood to be uſed in this eſſay.

Before proceeding directly to the ſubject, it muſt be further obſerved, that the object propoſed being only the examination and reformation of the tune of inſtruments, the theory of muſic is not meant to be introduced, further than in ſtating facts: and this liberty ſhall be uſed ſparingly, keeping cloſe to what ſeems ſtrictly neceſſary for the preſent purpoſe; the object aimed at being the improvement of the art, not rank among the learned.

The reader is ſuppoſed to have acquired an ordinary degree of acquaintance with the manner of writing muſic, and with performance upon ſome inſtrument. Very little of the laſt is requiſite; only he ought either to be able to draw a fine tone from the fiddle, or procure ſome perſon who can do it, for the purpoſe of examining the experiments propoſed to be made upon that inſtrument.

The utmoſt care muſt be taken, that the ſtrings be juſt, and that the tune of them be made perfectly chord of fifth to each other: a very ſmall defect in either of theſe conditions will ruin the experiment. We muſt even deſcend to adviſe, that the fiddle which is to be uſed for trying theſe experiments, be kept perfectly free from all damp.

It has been already ſaid, that there are two modes of muſic, diſtinguiſhed from each other by the different order of the degrees of tune from the key-note: one of them requiring the third, ſixth, and ſeventh, greater; and the other, the third, ſixth, and ſeventh, leſſer. If the ſame pitch of tune be taken as the key-note to both, the ſecond, the fourth, the fifth, and the octave, will be uniſon; the third, ſixth, and ſeventh degrees of the key-major, will be acuter by what is called half a note, than thoſe of the minor.

Although it has been ſaid, that the note C being aſſumed for the key-note of the major mode, A neceſſarily becomes the key-note of the minor; that is, when both are natural, and without ſigns ſharp or flat upon the cleff; yet thoſe who are acquainted with the manner of writing muſic, know, that, by the help of theſe ſigns, muſicians can regulate any key, from any note or half note. To make the comparative view of the two modes more plain, the two ſcales, repreſenting the degrees of each mode, are made to proceed from the ſame note C, the natural key-note of the major mode; fitting it, by flat ſigns, alſo to become the key-note of the minor. See the Scales, N° 1. and 2. And if a piece of muſic were compoſed and performed, ſo as to proceed through its changes of keys by the intervals marked in theſe ſcales perfectly adjuſted, the performance would be in true diatonic tune; at leaſt, for the preſent it may be ſo ſuppoſed.

By various experiments, it has been diſcovered, that the relation of one ſound to another may be meaſured by the number of the vibrations of the ſtrings producing ſound, accompliſhed in the ſame, or in equal times. Methods have alſo been found to eſtimate theſe relative numbers, and apply them to the calculation of muſical ſound.

Muſical ſounds are clear, even, and ſmooth tones, continuing for ſome ſpace of time without alteration in the degree of acuteneſs or gravity; in oppoſition to confuſed noiſe, or continuous tune: which laſt riſes or falls, not by ſteps or degrees, but in continuity; as does the tune of a fiddle-ſtring, when the finger is ſlid alongſt it.

The ratios of the degrees of tune have been determined to be as follows: The ratio of tone greater, as 8 is to 9; of tone leſſer, as 9 is to 10; and of ſemi-tone, as 15 is to 16.: the number of the vibrations of the ſtring producing the graver tone, being expreſſed by the leſſer number; and the number of the vibrations of the ſtring producing the acuter tone, being expreſſed by the greater number.

But obſerve, that this interval, 15 : 16, called *ſemi-tone*, is not the juſt half of either of theſe tones; for the ſum of two ſuch ſemi-tones added together, is greater than the tone greater. It is only called ſemi-tone, becauſe, being one of the true degrees of the diatonick ſcale, it does not much exceed half a tone greater; and muſicians, hitherto, neglecting this nicety of difference, have given it that name indiſcriminately with its complement to the tone greater, or tone leſſer. We ſhall, however, continue to give it the name of *ſemi-tone*, adding the word *elementary* when there is hazard of doubt, and diſtinguiſhing its complement to the tone greater by the name of *limma major*. And theſe three degrees, tone greater $\frac{8}{9}$,

2048 :
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tone leſſer $\frac{9}{10}$, and the elementary ſemi-tone $\frac{15}{16}$, ſhall be called in general *elements*; becauſe all tuneful ratios or intervals, and their differences, hitherto acknowledged, are conſtituted by the compoſition and reſolution of theſe.

From the Scales, N° 1. and 2. it appears, that, in the greater mode, one of the elementary ſemi-tones takes its place between the third and the fourth degrees of the ſcale, and the other between the ſeventh and the eighth; but, in the leſſer mode, theſe ſemi-tones fall, one between the ſecond and third, and the other between the fifth and ſixth degrees, all the other degrees being full tones.

But muſicians have found, as was formerly noticed, that to obtain the variety required for muſical entertainment, they muſt be furniſhed with the means of changing the note firſt aſſumed as the key-note, and of introducing another note as a new key-note at pleaſure; conſequently, the ſituation of the ſemi-tones (which muſt always take the place already aſſigned them in relation to whatever new key-note is introduced) muſt likewiſe be altered. For accompliſhing this end, the only means which has hitherto been fallen upon is, to ſuppoſe all the degrees called *tones* to be of equal dimenſions, and the *ſemi-tones* likewiſe to be equal and juſt halfs of the tones; neither of which ſuppoſitions are founded on truth. It is upon this falſe hypotheſis that all our inſtruments with fixed notes are formed; ſuch as organs, harpſichords, &c. In forming theſe, a note is inſerted between the extremes of each of the full tones, tuned as nearly as poſſible equidiſtant from both; and the places of the elementary ſemitones being left without the inſertion of any factitious ſemi-tone, the whole octave thus becomes divided into thirteen notes, each half a tone diſtant from the note next to it. This diviſion of the octave is repreſented to the eye in the diſpoſition of the finger-keys of the harpſichord or organ; the ſhort finger-keys repreſenting the factitious notes, and the long ones the natural notes. Flutes, hautboys, and other inſtruments of that kind, are ſtill in a worſe predicament. The gammuts contrived for them afford but an aukward ſupply of the artificial ſemi-tones, and thereby one error is added to another. Even the fiddle is not exempted from this general falſity of tune; for its natural tune ſhall be ſhewn to be falſe in all the keys but one.

Beſides the difficulties ariſing from the inequalities among the intervals, which have obſtructed the formation of inſtruments capable of true tune, there is another which has driven muſicians to deſpair of obtaining even a diviſion of the ſcale into equal hemitonic parts. This is, the impoſſibility of dividing the tone greater and tone leſſer into equal parts, or of finding any interval which may accurately repreſent the half of the ſum of the tone greater and tone leſſer added together, ſo as to make a ſet of equal factitious full tones.

Theory teaches, that the relation of the degrees of tune depends upon the relative numbers of vibrations producing ſound, performed in equal times. It is therefore from the relations of numbers that the relations of tuneful ſounds muſt be diſcovered.

To divide an interval of tune into two equal parts, muſt be to place a middle tone between the extremes of that interval, the number of whoſe vibrations, in a given time, ſhall bear the ſame geometric ratio to thoſe of the lower extreme of the interval to be divided, as the number of the vibrations of its higher extreme, performed in the ſame time, does to thoſe of the middle tone.

For example: Let 2 and 8 repreſent the number of vibrations performed in the ſame or equal times, by two ſounding bodies. If it be required to put a note between them, which ſhall be a true mean to theſe extremes, their geometric mean muſt be found. This is done by multiplying them together, and extracting the ſquare root of the product. Thus, 2 and 8 multiplied give 16, the ſquare root of which is 4. If 4, therefore, be placed between the two given numbers, it ſhall be a true mean, dividing the interval into parts perfectly equal. Thus the ratio 2 : 8 is known to repreſent a double octave; and 2 : 4, or 4 : 8, whoſe ratios are equal, both repreſent a ſingle octave; and the equal diviſion of the given ratio of tune 2 : 8 is accurately repreſented by theſe numbers 2 : 4 : 8.

But the extremes of the tone greater being 8 : 9, if theſe are multiplied together, the ſquare root is ſurd, and cannot be found in rational numbers; therefore no middle term can be inſerted between them, which, in rational numbers, can bear the ſame proportion to the leſſer as the greater does to it. The extremes of the tone leſſer are in the ſame predicament; and it is alſo impoſſible to divide the ſum of the tone greater added to the tone leſſer, ſo as to find a mean full tone. Thus, a true geometric mean, being every way impoſſible to be found in rational numbers, which only are applicable to calculations of tune, the equal diviſion of the ſcale into half-notes is alſo impoſſible; and the falſity of the tune of inſtruments muſt be increaſed, even beyond what at firſt ſeems to flow from the falſe hypotheſis upon which they are conſtructed.

And further, were it even poſſible that the tone greater and tone leſſer could be equally divided, or that a full tone, equal to the half of the ſum of theſe two added, could be found, and equally divided, the ſum of any number of ſuch half-notes, or the ſum of any number of elementary ſemi-tones, would either exceed or fall ſhort of the true interval of octave. Thus, beſides the falſity of ſuch a diviſion in reſpect of other intervals, it would alſo ruin the perfection of the octave, the only interval hitherto remaining entire, as a barrier againſt utter demolition.

Theory teaches, that the difference between the tone greater and the tone leſſer is accurately repreſented by the ratio

80:81,

80 : 81, called *comma.* The next expedient, therefore, that naturally occurs, is to attempt a diviſion of the elements, down to ſuch a number of commas as they may contain. But, beſides the difficulty that would be found in performing upon an inſtrument accoutred with ſuch a multitude of finger-keys, it is found that comma cannot divide any of the three diatonick elements, without leaving a remainder; and the matter, even in reſpect of bare poſſibility, is left hopeleſs in all theſe views.

Yet we deſpair not of being able to give rules, eaſy to be followed by a performer upon the violin, which will direct him towards perfect tune, and enable him to approach it as near as his induſtry and command of hand will permit; qualifying him alſo to judge of errors with the utmoſt preciſion.

We hope alſo to be able to give ſuch plans of conſtruction for other inſtruments, as will afford perfect tune in every key, free from all defect or exceſs, even in the relations of the internal intervals of the ſcale of muſic; the correction of which has hitherto baffled the moſt anxious eſſays.

CHAP. II.

Of the relation of the minor to the major mode; and of the nature of tuneful intervals.

BY comparing the degrees of the two modes, (ſee ſcales, N° 1. and 2.) it will appear, that the ſixth of the greater mode, which is A, being ſuppoſed to be key-note, and thence reckoning upwards, the tones and ſemi-tones ſucceed each other in the ſame order as they do from the key-note C, in the ſcale N° 2.; excepting only the interval between the third and the fourth, being E and F, which, in the ſcale N° 2. is tone leſſer; but, in the ſcale N° 1. reckoning upwards from A, to the third and fourth above it, being C and D, the interval is tone greater; and alſo the interval between the fourth and the fifth of the ſcale N° 2. being F and G, which is tone greater; but, in the ſcale N° 1. reckoning upwards from A to its fourth D and fifth E, the interval between theſe two notes is tone leſſer.

If D be flattened by comma, the interval between C and D will become tone leſſer; and the interval between D and E, conſequently, will thereby become tone greater: by which correction, the progreſs of the degrees from A, the ſixth of the greater mode, will become perfectly the ſame with the true diatonick progreſs of the degrees of the leſſer mode from the key-note.

But as the difference of the greater and leſſer tone has hitherto been neglected by muſicians, the ſixth of the major mode has always been admitted as the key-note to the minor mode, without adding any mark of diſtinction to ſignify the true pitch of the fourth of the minor, and point out the difference between it and the ſecond of the major mode. This, however, muſt not now be neglected, ſeeing we aim at the diſcovery of perfect tune; to which that, or any omiſſion whatever, would juſtly forfeit all title.

The diatonick degrees, or elements of muſic, which tunefully divide the ſcale, being thoſe already mentioned, tone greater, tone leſſer, and ſemi-tone; in the computation of all true muſical intervals, no other degrees muſt be admitted, nor even fractions of theſe degrees: for it is believed, that every interval, which cannot be meaſured by theſe degrees as integers, is falſe. Whether or not this be ſtrictly true, may afterwards appear; but, in the mean while, we follow the eſtabliſhed opinion.

Every interval of tune muſt thus be commenſurable by theſe elementary degrees as integers, when a note is compared with its key-note, or with any other note to which it ſtands related in the ſame ſyſtem of melody or harmony. But it muſt not be underſtood, that no other methods of computation can be uſed to find the differences of particular notes belonging to the ſame general ſyſtem of twenty-four keys; many of which are hitherto ſuppoſed to have no connection with each other in direct harmonical or tuneful relation; and therefore ſuch differences are liable to no ſuch reſtriction in computing them. But this will not be perfectly underſtood till we arrive at the place where ſuch methods of computation become neceſſary.

The tables, where each muſical interval is computed by the number of elements it contains, will ſerve as a guide in our progreſs through the whole keys of muſic. See the ſcales N° 3. and N° 4. where the muſic-lines, or *ſtaff* as it is called, contains the notes as they ariſe upwards from the reſpective key-notes. The quantity of each interval is marked in writing, between each of the notes and that next to it; its name, as *key-note*, or as *ſecond*, or *third*, &c. of the key, is marked under the ſtaff; and the ſum of its diſtance from the key-note, in the different elementary degrees, is marked in columns below. But it muſt alſo be obſerved, that the terms, *third greater*, *third leſſer*, *fourth*, *fifth*, &c. likewiſe mean, That any two notes, whoſe interval, in reſpect of each other, is the ſame as theſe are to the key-note, are ſaid to ſtand as third, fourth, fifth, &c. to each other: but, to prevent ambiguity, the meaning ſhall be clearly marked, by ſaying, *ſecond*, *third*, &c. of the key, when the relation of any note to the key-note is meant to be expreſſed; when its relation to any other note is meant, it ſhall be called *chord* of third, &c. to that note.

It muſt likewiſe be premiſed, that no other intervals are acknowledged as muſical but thoſe above referred to, comprehended in the two ſcales N° 3. and 4.: and every interval that is not equal to one or other of theſe, is deemed to be out of tune; for, as already noticed, after paſſing the bounds of the octave, the other notes are only a repetition of the former intervals either above or below. The octave and ſecond, called *ninth*, is properly eſtimated in compoſition as a ſimple ſecond: ſo alſo the octave and third, tho' *tenth*, is of no other value than a ſimple third; and ſo on, after paſſing double or triple octave above or below.

It is true, that a falſe fourth, called the *tritone*, and a falſe fifth, called the *ſemidiapente*, are alſo in uſe; but theſe need not be particularly noticed here.

Theſe ſcales, N° 3. and 4. are drawn for the purpoſe of examining the degrees of tune. Every interval which correſponds not preciſely with one of thoſe marked in the ſcales, both in the number and ſpecies of its component elements, muſt be held to be falſe; and all the intervals marked in the ſcales, except the ſecond and ſeventh, are called *concords*. The ſecond and ſeventh, with the falſe fourth and fifth, are called *concinnous diſcords*; becauſe they are held to be diſagreeable, when produced in conſonance, without relation to others: yet they afford very agreeable effects, when properly prepared and reſolved in compoſition, either as melody or harmony.

CHAP. III.

A general examination of the tune of the fiddle, and experiments upon the manner of ſtopping it.

WE ſhall now proceed to examine the tune of the fiddle, and learn wherein it diſagrees or coincides with the intervals of tune, in ſcales N° 3. and 4.

The four ſtrings of a fiddle being tuned juſt chords of fifth, each to the others next it, after the common method; and the chord of fifth appearing from both theſe ſcales to be compoſed of two tones greater, one tone leſſer, and one ſemitone, which, in computations of this kind, ſhall be diſtinguiſhed by the letters G, L, S, ſignifying tone greater, tone leſſer, and ſemi-tone.

	G.	L.	S.
The third ſtring will be acuter than the fourth ſtring by	2	1	1
The ſecond ſtring will be acuter than the third by -	2	1	1
The ſum of the interval of tune between the fourth and the ſecond ſtring is - -	4	2	2

Upon looking into the ſcales, N° 3. and 4. this interval, $\overset{G.}{4}:\overset{L.}{2}:\overset{S.}{2}$, will be found to ſtand in both as ninth to the key-note; and conſequently the tune of the open fourth ſtring being aſſumed as the key-note, the open third ſtring, and alſo the open ſecond ſtring, are both in the true tune of that key. To theſe let us now add the tune of the open firſt ſtring, being ſtill acuter than the tune of the ſecond ſtring by the chord of fifth.

	G.	L.	S.
The former ſum was	4	2	2
The firſt ſtring is acuter than the ſecond by - -	2	1	1
The ſum of theſe is -	6	3	3

The

This ſum is nowhere to be found in theſe tables; therefore the open firſt ſtring E is not in tune to the open fourth ſtring G, which laſt is in this caſe the key-note.

In computing the interval between the open fourth ſtring and the open ſecond ſtring, it was found, that theſe two degrees of tune ſtand in the true relation of ninth to each other; and it is known, that the interval of ninth is equal to the octave and tone greater. If, therefore, the third ſtring be ſtopped, ſo as to give the true chord of octave to the open fourth ſtring, the remaining interval between the tune of the third ſtring ſo ſtopped, and the open ſecond ſtring, muſt be the tone greater. And, univerſally, when any three ſtrings are tuned juſt chord of fifth to each other, if the middle one be ſtopped ſo as to give octave to the loweſt, the interval between this ſtopped note and the open tune of the higheſt of the three muſt be the tone greater. Plate VIII. fig. 19.

But if, inſtead of ſtopping this note, G, upon the third ſtring, octave to the open fourth ſtring, the ſecond ſtring ſhould be ſtopped in uniſon to the firſt ſtring; then taking the tune of G upon the third ſtring, as chord of ſixth greater below the uniſon of the open firſt ſtring, it will be found, that G upon the third ſtring, thus ſtopped, will not give the chord of octave to the open fourth ſtring, being ſomewhat too acute. See Plate VIII. fig. 20.

In ſcale N° 3. it will be found, that the chord of ſixth greater is an interval compoſed of the chord of fifth and the tone leſſer; therefore the interval now exiſting between G, ſtopped in this laſt way, and the open tune of the ſecond ſtring, muſt be the tone leſſer. The ear will be found to diſtinguiſh ſo minutely in this and the following experiments, that one is tempted almoſt to aſſert, that the very *punctum* of perfect tune is diſcernible.

Comma being the difference between the tone greater and the tone leſſer; the difference between G ſtopped octave to the open fourth ſtring, and the ſame note taken as chord of ſixth greater below the tune of the firſt open ſtring, muſt be comma. Thus we learn how to tune comma with great preciſion; and this diſtinction may be made upon every note of the fiddle, as will appear from the regulated ſcales afterwards to be mentioned: from which is drawn this general inference.

Firſt general Inference.

When four ſtrings, or chords, are tuned true chord of fifth to each other, as in the tune of the fiddle; if the loweſt but one be ſtopped octave to the loweſt, the interval between the tune of that ſtop, and the open tune of the higheſt but one, is tone greater. But if it be ſtopped chord of ſixth greater to the open tune of the higheſt ſtring; the interval between that ſtop, and the open tune of the higheſt but one, is tone leſſer; and the difference of thoſe two ſtops is comma.

Two examples more ſhall be given of the manner of tuning comma, or, which is the ſame thing, of regulating the difference between the tone greater and the tone leſſer, before examining the ſcales for the regulation of the tune of the fiddle.

The firſt finger, placed upon the ſecond ſtring, ſo as to give B natural, may be taken as chord of fourth to the open firſt ſtring, or as chord of ſixth greater to the open third ſtring. If the finger be accurately adjuſted, ſo as to give the perfect chord of fourth to the open firſt ſtring, and, continuing it in the ſame poſition, the bow ſhall ſtrike the open third ſtring along with the ſecond ſtring thus ſtopped, they will be found to be out of tune. Move the finger a ſmall ſpace backwards, ſo as to flatten the ſtop a little; it will then give the perfect chord of ſixth greater with the open third ſtring: but, in this poſition, the chord of fourth with the open firſt ſtring will be deſtroyed; and theſe two concords cannot be ſtruck in tune, from the ſame poſition of the finger. See Plate VIII. fig. 21. 22.

The chord of fourth, containing one tone greater, one tone leſſer, and one ſemi-tone; and that of the ſixth greater, containing two tones greater, two tones leſſer, and one ſemi-tone, (ſee the ſcale, N° 3.) may be added thus:

	G.	L.	S.
Chord of fourth -	1	1	1
Chord of ſixth greater	2	2	1
Sum - -	3	3	2

The interval of tune between the open third ſtring and the open firſt ſtring has been ſhewn to be a ninth, which contains four tones greater, two tones leſſer, and two ſemi-tones. Thus each of theſe intervals contains ſix tones and two ſemi-tones. But the interval compounded of the chords of fourth and ſixth is the leaſt of the two; becauſe, in balancing the ſums, it is leſs than the other by the difference between the tone minor and the tone major, which is comma.

Therefore the interval between the pitch of tune which gives the chord of fourth with the firſt ſtring, and that which gives the chord of ſixth greater with the third ſtring, muſt be comma.

Second general Inference.

Hence is drawn this other general inference, That, among any number of ſtrings tuned as a fiddle, when any one of them is ſtopped chord of ſixth greater to the open ſtring next below, that ſtop is comma flatter than the ſtop upon the ſame ſtring which gives the chord of fourth with the next higheſt ſtring; the firſt of theſe ſtops giving the interval of tone leſſer, and the other giving the interval of tone greater to the ſame ſtring open.

The next example ſhall be given to afford an opportunity of exhibiting the difference of the extremes of tune containing comma, to the ear in direct compariſon; of forming thereby a judgment of ſuch an error, and of the advantages which muſt reſult from its baniſhment.

It has been proved, that the loweſt and higheſt of three ſtrings tuned chord of fifth to each other give the interval called *ninth*, which is the ſame as octave to the ſecond.

The ſecond of the key is tone greater above the key-note. Suppoſing, then, the open third ſtring to be aſſumed as a key-note; ſtop that ſtring, ſo as to give the chord of fourth to the open Second ſtring: and preſerving that poſition (Plate VIII. fig. 23.) for E′ upon the third ſtring, with the fourth finger ſtop E′ upon the ſecond ſtring, octave to E′ upon the third ſtring, (fig. 24.). E′ thus ſtopped upon the ſecond ſtring, will be found to be true uniſon to the open firſt ſtring; which laſt was proved already (page 29.) to be the ninth of the key. Therefore E′, thus taken upon the third ſtring, is tone greater to the ſame ſtring open, D. By inference ſecond above, when a ſtring is thus ſtopped chord of fourth to the next open ſtring above it, it is comma ſharper than when ſtopped chord of ſixth greater to the open ſtring below. Again, ſtop the third ſtring in E chord of ſixth greater to the open fourth ſtring G, (Plate VIII. fig. 25.); and after the chord is accurately adjuſted, carefully preſerve the poſition of this laſt found E, and take its octave with the fourth finger upon the ſecond ſtring, (fig. 26.). This laſt-mentioned E upon the ſecond ſtring will be found to be flatter than the tune of the open firſt ſtring, and the difference is comma. A ſhocking difference it is, when thus brought into direct compariſon; and it is not to be doubted, but that a performer would think himſelf highly affronted if he were told, that he is often ſo much, and ſometimes much more, out of tune.

CHAP. IV.

Explanations preparatory to a particular examination of the regulated ſcales for the tune of the fiddle, and of the regulation of tune in general.

BEFORE examining particularly the regulated ſcales for the tune of the fiddle, it ſeems further neceſſary to premiſe ſome few things.

In the firſt place, whenever there ſhall be occaſion to mention the keys of muſic as proceeding in their order, it muſt be underſtood to be meant of the order in which they ariſe from the natural key, either by the addition of ſharp or of flat marks, without diſtinction of the greater and leſſer mode, unleſs expreſsly ſpecified. For example, when mention is made of the order of the keys with ſharps, it is meant that the natural keys ſtand firſt in that order; and next, the keys with one, two, *&c.* ſharps, to the keys with ſix ſharps, which are the laſt in that order.

In the ſame manner, when the order of the keys with flats is mentioned, it is meant, that the natural keys ſtand firſt in that order; and next, the keys with one, two, &c. flats, to the keys with five flats, which are the laſt in that order. And when the preceding key, or keys, to any particular key is mentioned, this expreſſion points out the key or keys having one mark of flat or ſharp fewer; and by the following key or keys, are meant thoſe having one more of theſe marks. The word *ſignature* will be uſed, when both the major and minor mode, which are ſigned with the ſame ſharp or flat marks, are meant to be expreſſed jointly. But there may be occaſion ſometimes to conſider the keys in an order, beginning with five flats, and proceeding by thoſe having one flat fewer towards the natural keys, and thence forward, by thoſe having one ſharp more each, to thoſe with ſix ſharps; the keys with five flats being the firſt, and thoſe with ſix ſharps the laſt, in this order. In ſuch caſe, the order meant ſhall be diſtinguiſhed by the words, *order of five flats;* and when the reverſe of this order is meant, it ſhall be diſtinguiſhed by the words *the order of ſix ſharps.* When the word *key* ſhall be uſed in the ſingular number, it muſt be underſtood to refer to one particular mode only. The word *keys* in the plural, if not limited, ſhall refer to the whole twenty-four keys of muſic. And becauſe thoſe parts of the harpſichord or organ by which the notes are ſtruck are alſo called keys, for diſtinction's ſake they ſhall be called *finger-keys.*

It muſt alſo be noticed, that the word *key* is ſometimes uſed by muſicians for expreſſing the whole ſyſtem of tune belonging to one particular mode, and ſometimes only to expreſs the key-note. When the word *key* ſhall be uſed alone, it is to be underſtood in the former ſenſe; the words *key-note* ſhall always be uſed when the note itſelf is meant.

We ſhall now offer a few general obſervations upon the tranſition from one key to another in their order, before entering upon the examination of their regulation in particular.

In paſſing from the natural key major to the key major with one ſharp, or from any key major with ſharps to the ſucceeding key major in order with ſharps, the fifth of the given key muſt be taken as key-note to the new key; conſequently, the ſixth of the given key now ſtands in place of the ſecond of the new key. In the diatonick ſcale, the interval between the key-note and the ſecond of the key is tone greater; but the interval between the fifth of the key major, and the ſixth of the ſame, is tone leſſer: therefore the ſixth of the given key muſt be raiſed higher by comma, to make it a true ſecond to the new key.

Alſo, the interval between the fourth and the fifth of the given key being tone greater, and that between the ſeventh and the eighth being ſemi-tone, the fourth of the given key muſt be raiſed limma major, ſo as to make it approach to the juſt diſtance of ſemi-tone from the fifth, now become the key-note; by which alteration, it becomes a proper ſeventh to the new key: and theſe changes being made, all the other notes of the given key hold their pitch, and form true intervals for the new key.

The ſcale N° 5. will help to a clear apprehenſion of the matter: where, from C upwards to an octave above G, the diatonick progreſs of the intervals is marked above the ſcale as proceeding from C, the natural key-note of the major mode; and from the lower G, as the new key-note for the key major with one ſharp, the ſame progreſs of intervals is marked below the ſcale: which points out clearly what notes continue in the ſame pitch of tune common to both keys, and how much the others are to be altered.

Thus, in the tune of the key major natural C, the interval between G and A is marked tone leſſer above the ſtaff; but, in the key major G with one ſharp, the interval between G and A is marked tone greater below the ſtaff, ſhewing that the tune of A, as it ſtands in the key of C natural, is comma too flat for the key of G with one ſharp. A, therefore, being raiſed comma, it becomes a true ſecond to G, now conſidered as a key-note.

Again, in the natural key major C, the interval between A and B is tone greater: but B being the third from the new key-note G, and the interval between the ſecond and third of the natural key major being tone leſſer, the interval between A and B ought to become tone leſſer. But this is already effected in the correction of A juſt now made; which, for the reaſon given, was moved comma higher, thereby approaching to B, and diminiſhing the interval between A and B. Thus the interval between A and B is now become tone leſſer; and conſequently it ſtands in its true relation to the new key G, without any alteration of B.

The interval between B and C is ſemitone in the natural key of C; and theſe two notes, being the third and fourth of the new key of G with one ſharp, the interval between them there ought alſo to be ſemitone, and ſo needs no correction. Alſo, the intervals between C and D, and between D and E, are the ſame in both keys; but the intervals between E and F, and between F and G, ſtanding in the key major C natural, as ſemi-tone and tone greater, and reciprocally in the key of G with one ſharp, as tone greater and ſemi-tone. In order, therefore, to raiſe the tune of F in the key natural C, to the pitch it ought to hold in the new key of G with one ſharp, it muſt be raiſed by a limma major, ſo as to approach to the juſt diſtance of ſemi-tone from G; and conſequently become tone greater above E, the ſixth of the key G. This laſt correction, in common practice, is ſignified by marking a ſharp upon F, while the correction of the ſecond of the new key is neglected.

Thus it appears, that, in altering the tune of an inſtrument from a given key, in the true diatonick tune of the greater mode, ſo that it may afford the ſame intervals of tune, when the fifth of that key is aſſumed as a key-note to another key major, two degrees of tune are only required to be altered; one, the ſixth of the given key, which becomes ſecond to the new key; and the other, the fourth of the given key, which becomes ſeventh to the new key.

If it ſhould be required to tune one key major from another, by taking the fourth of the given key as a new key-note rather than the fifth, the ſame effect will be produced, if the method of proceeding be juſt reverſed. Inſtead of raiſing the tune of the ſixth and fourth of the given key as above, to adjuſt them to the tune of the new key, the ſecond and ſeventh of the given key muſt be flattened. The ſecond of the given key being flattened by comma, thereby becomes a true ſixth to the new key; and the ſeventh of the given key being flattened by limma major, thereby becomes a true fourth to the new key: which laſt, in common practice, is marked with a flat, and the correction of the other is neglected.

While the derivation of one key from another proceeds by taking the fifth of each preceding key major in order, as the key-note of the ſucceeding key major, the notes to be altered from the pitch they hold in the given key muſt be corrected by raiſing their tune, and diſtinguiſhing each new key by an additional ſharp mark. This courſe may be followed without much embarraſſment, till it reaches to the ſignature of ſix ſharps: but then theſe marks become ſo numerous, that it ſeems better to return to the natural keys, and to proceed anew from them, as it were by a reverſed progreſſion; the fourth of each preceding key becoming the new key-note, and a flat mark being added to the ſignature of the new key till the progreſs arrives at the ſignature of five flats. Theſe, with the natural keys, and the ſix ſignatures with ſharps, complete the twelve ſignatures; each ſignature comprehending a key major and a key minor;

in all, twenty-four keys, being the received ſyſtem of muſic.

Theſe two methods of deriving one key from another, by the addition of ſharp or flat marks, make not the ſmalleſt difference in the connection or tune of the keys.

A little reflection will make it plain, that the ſharp keys and flat keys thus derived, hold the ſame connection with each other in the general order of the keys from five flats to ſix ſharps, as the flat keys do among themſelves, or as the ſharp keys do among themſelves. The complete ſyſtem of twelve ſignatures might be formed, by proceeding to derive one key from another, ſtill taking the fifth of the laſt key as key-note to the ſucceeding key, and adding a ſharp or double ſharp mark; and the laſt of theſe would be in the ſignature of eleven ſharps.

In ſuch a caſe, the ſyſtem of tune would be exactly the ſame as by the preſent method. The only difference would be, that that ſome of the ſignatures would be crowded by ~~the~~ a multiplicity of ſharp and double ſharp marks. The ſame may be ſaid if the whole keys ſhould be formed in ſucceſſion by the addition of flats, after the manner preſcribed. But the uſe of both ſharp and flat marks ſaves the inconvenience that would be occaſioned by the multiplicity of marks which either of the other two methods would require in the advanced ſignatures.

From what has been ſaid, the four following rules are deduced:

RULE I.

For forming a key major with an additional ſharp from the natural key major, or from any key major with ſharps.

Take the fifth of the given key as the new key-note. Raiſe the fourth of the given key by limma major; which thereby becomes a true ſeventh to the new key. Raiſe alſo the ſixth of the given key by comma; which thereby becomes the true ſecond to the new key. All the other notes are of a pitch common to both keys.

RULE II.

For forming a key major with an additional flat, from the natural key major, or from any key major with flats.

Take the fourth of the given key as a new key-note. Flatten the ſeventh of the given key by limma major; which hence becomes a true fourth to the new key. Flatten alſo the ſecond of the given key by comma; which hence becomes a true ſixth to the new key. All the other notes are of a pitch common to both keys.

RULE III.

For forming a key minor from a given key major of the ſame ſignature, ſee page 22. *and ſcales* N° 1. *and* 2.

Take the ſixth of the key major of any given ſignature as the key-note for the minor of the ſame ſignature. Flatten the ſecond of the key major by comma; which hence becomes a true fourth to the minor.

nor. All the other notes are of a pitch common to both.

But muſicians know, that in place of the ſixth and ſeventh leſſer, which are its natural and diſtinguiſhing notes, the key minor often requires its ſixth and ſeventh greater. The tune of theſe muſt therefore alſo be found, for the occaſional uſe of the minor mode.

RULE IV.

For finding the tune of the major ſixth and ſeventh of the minor mode.

Tune the ſixth and ſeventh greater of the minor mode by the ſame relation of chords to the key-note, as the ſixth and ſeventh of the major mode are tuned.

Before proceeding directly to the particular regulation of tune in the following ſcales, it is neceſſary ſtill further to premiſe, That to be able the more diſtinctly to apprehend what preciſe pitch of tune is meant to be expreſſed by each particular note; beſides the common marks of flat and ſharp, hitherto alone in uſe to diſtinguiſh, though groſsly, the riſe and fall of half a note, it is neceſſary, in treating of this refined regulation of tune, likewiſe to uſe other marks; and the grave (\`) and acute (′) accents are choſen. It will likewiſe be neceſſary to uſe a negative mark, having a ſimilar effect upon theſe accents as the natural mark has upon the ſharp and flat marks. A ſmall cipher is choſen for this purpoſe; and the ſtricteſt attention muſt be paid to theſe marks.

The ſharp, flat, and natural marks, and the acute, grave, and negative marks, are meant to be applied as follows. The degrees of the key major C natural, tuned by perfect diatonick intervals, ſhall be conſidered as the ground from which every other pitch of tune is derived, as it ſhall ariſe in proceeding through the other keys in order. The ſharp, flat, and natural marks, ſhall always be uſed to ſignify preciſely the riſe or fall of the interval now called the *limma major*. The word *limma* has been hitherto uſed inaccurately to ſignify half a tone in general; but the limma major muſt now be ſtrictly underſtood to ſignify the remainder, after the elementary ſemi-tone 15 : 16 has been ſubtracted from the tone greater 8 : 9, being a ratio of 128 : 135. The acute and grave marks, and their negative, ſhall be uſed alſo to ſignify preciſely the riſe or fall of comma. Theſe grave and acute marks ſhall be placed on the beginning of each ſtaff of muſic-lines, as well as the ſharp and flat marks hitherto only in uſe; and they muſt be underſtood to influence the degrees of tune, on the lines and ſpaces upon which they are placed, in a ſimilar manner.

The regulation of the tune of the fiddle, which is the ſubject of the two following chapters, is purpoſely inſerted, prior to any further account of the properties of the ſcale of muſic, or the application of it to the tune of the organ; becauſe it furniſhes opportunity for great variety of experiments upon tune: and in all inveſtigations of this kind experiment ought to lead the way.

It is true, that the ſcale of muſic, as it has already been exhibited in the introduction, ſupplies all the materials which are intended to be uſed in the following deductions; and it is alſo true, that it is derived from accurate experiments, made in the earlieſt times, which have ſtood the teſt of keen examination in all ages. But the few experiments upon the fiddle which have been premiſed, and the reſt which follow, afford an opportunity of examining it upon an inſtrument with which we are familiarly acquainted; and ſhew ſo happy a coincidence with what has been delivered by theoriſts, that it is thought better to take this direct ſanction from the ſenſes along with us, than to proceed merely by reference to theory, without firſt laying hold of ſo eaſy an opportunity of examination.

Agreeable to the received doctrine concerning the ſyſtem of muſical keys, this regulation of tune for the fiddle has been carried through all the twelve ſignatures, or twenty-four keys of muſic. But as the chain is long, and every link ſtrictly dependent on another, to go thro' the whole at firſt may prove tedious to moſt inquirers. Two ſignatures, or at moſt three, carefully examined, will convey a pretty clear idea of the nature of the whole regulation, which becomes more intricate as it advances in numbers of ſharps or flats; not from any alteration in the nature of the tune of the keys, but from the nature of the inſtrument, which becomes leſs fit to afford acceſs to derive the tune of theſe advanced keys from the tune of the ſtrings.

It may be recommended, however, to peruſe part of Chap. VI. on the pitch of the keys with flats; and one or two of theſe may likewiſe be traced.

But, to a perſon who is altogether unacquainted with the practice of the fiddle, the examination of the ſimpleſt of theſe ſcales will be very difficult, if not impracticable. Therefore it muſt be entirely relinquiſhed; and the ſcale of muſic, as exhibited in the introduction, be admitted as true, without this additional teſtimony from the ſenſes, in confirmation of what theoriſts have formerly eſtabliſhed upon experiments differently made.

CHAP. V.

Of pitching the key-note C natural upon the fiddle, and hence regulating the tune of all the keys with ſharps.

MANY reaſons concur for chooſing the tune of the open fourth ſtring of the fiddle as the pitch for the tune of the fifth of the key major [illegible] C natural: for altho' it neceſſarily renders two of the open ſtrings of the fiddle falſe to this key; yet upon the whole, it gives the eaſieſt acceſs to regulate the tune of the inſtrument, by appealing, in the ſimpleſt manner, to the fixed tune of the open ſtrings in general as a guide.

Another reaſon is, that the modulation from this key to the key major with one ſharp is moſt natural; in which caſe, the open fourth ſtring becomes the key-note. Were it otherwiſe pitched, it would be almoſt impoſſible to prevent the influence of the tune of the open fourth ſtring from miſleading the tune of both theſe keys. Theſe reaſons ſeem ſufficient; and it is needleſs to add more, ſince the explanation of this matter at large would be tedious, and the remaining reaſons may be referred to the reader's obſervation from the explanation to be given of the regulated ſcales. See N° 6. to N° 17.

To each of the ſignatures are given four ſtaves of muſic-lines. The higheſt contains the tune of the key-major in true diatonick intervals. The ſecond, marked flat ſevenths and grave ſeconds, cannot be underſtood, till ſome particular properties of tune ſhall be explained afterwards in Part II.; and at preſent the degrees of tune in that ſtaff may be left unnoticed. The third ſtaff repreſents the natural tune of the key minor; and the regulation of all its notes being the ſame with thoſe ſet directly over them in the firſt ſtaff of the major, the notes are ſimply marked, and the regulation of their tune referred to the higheſt ſtaff: except the fourths, which by Rule 3. are comma flatter than the ſame notes of the major; and therefore their own regulation is given to them. The fourth ſtaff contains the regulation of the ſixths and ſevenths greater of the minor, according to Rule 4. The regulation of theſe laſt could not properly be placed in the other ſtaff of the minor; becauſe it is neceſſary that the ſixth and ſeventh of the minor, which are more particularly conſidered as natural to the key, ſhould ſtand there, to indicate a reference to the regulation of their tune in the higheſt ſtaff of the ſignature.

KEY MAJOR C NATURAL.

Of the Natural Keys; ſee Scale N° 6. Staff 1.

5th of the key, G. The tune of the open fourth ſtring, as has been ſaid, being aſſumed as the fifth of the key; and it having alſo been ſhewn (page 29.) that the pitch of tune which gives the chord of fifth above the fifth of any key, is a true ninth to the key, or, which is equivalent, is the ſecond of the key; and the third ſtring being tuned chord of fifth above the fourth ſtring, theſe two ſtrings open ſtand both in the true tune of this key; the open fourth ſtring being the fifth, and the open third ſtring being the ſecond, of the key.

6th of the key, A. The interval between the fifth and the ſixth of any key in the greater mode is tone leſſer. See ſcale N° 3. But, by the ſame ſcale, the chord of ſixth greater contains two tones greater, two tones leſſer, and one ſemi-tone; from which ſubtract a chord of fifth, viz. two tones greater, one tone leſſer, and one ſemi-tone, the difference is one tone leſſer. Stop the third ſtring ſo as to give the chord of ſixth greater above the open fourth ſtring; and the difference between the tune of the open third ſtring and the note thus ſtopped being ſuch an addition to the chord of fifth (the tune of the third and fourth ſtrings) as completes the chord of ſixth greater, it muſt be the tone leſſer. Transfer this poſition of the finger from the third to the fourth ſtring, (which is done by ſtopping them ſquarely, ſo that when both are ſtopped they give the chord of fifth), and the note wanted is found, being A, the true ſixth of this key: becauſe this ſtop upon the fourth ſtring, being to the tune of the ſame ſtring open as the ſtop upon the third ſtring was proved to be to the tune of that ſtring open, that is, tone leſſer; therefore A thus ſtopped upon the fourth ſtring is tone leſſer above the open fourth ſtring, which is the fifth of the key.

7th of the key, *B*. The chord of third greater is compoſed of one tone greater and one tone leſſer; and the chord of third leſſer, of one tone greater and one ſemi-tone: the ſum of theſe, being two tones greater, one tone leſſer, and one ſemi-tone, is equal to the chord of fifth. The ſtrings of the fiddle being tuned by fifths, and B the ſeventh of the key, by ſcale N° 3. being chord of third greater above the fifth of the key; ſtop the fourth ſtring ſo as to give the chord of third leſſer below the open third ſtring, the remainder between that ſtop and the tune of the open fourth ſtring muſt be a chord of third greater; and therefore the note B, thus ſtopped, is in the tune of the key.

Key-note, *C*. Let G upon the third ſtring be ſtopped octave to the open fourth ſtring, and that ſtop transferred, as before, from the third ſtring to the fourth ſtring by the chord of fifth; this ſtop, thus transferred upon the fourth ſtring, ſhall be in the true pitch of the key-note C; for the chord of fifth being ſubtracted from an octave, the remainder is the chord of fourth. This transferred ſtop muſt therefore be higher than the tune of the open fourth ſtring by the chord of fourth: But the tune of the open fourth ſtring is the fifth of the key; therefore this transferred ſtop muſt be the key-note.

THIRD STRING.

2d of the key, *D.* The open third ſtring D has already been ſhewn to be the juſt ninth, or ſecond to this key; and therefore is tone greater above C. See alſo the firſt general inference, page 32.

3d of the key, *E.* E upon the third ſtring, when tuned chord of ſixth greater above the open fourth ſtring, is tone leſſer above the third ſtring open, by the ſecond general inference, page 35.; and the interval between the ſecond and the third of the key in the greater mode (ſcale N° 3.) being tone leſſer, E thus tuned is a juſt third to the key.

4th of the key, *F.* C, the key-note upon the fourth ſtring, being found as before, F upon

F upon the third ſtring, which is the fourth of the key, muſt be taken chord of fourth higher.

5th of the key, *G*. G upon the third ſtring, taken octave above the open fourth ſtring, muſt be true fifth of the key.

6*th of the key*, *A*. But if the third ſtring be ſtopped in the manner directed for G, (by inference firſt, p. 32.) the tune of the open ſecond ſtring is tone greater above G thus ſtopped; and by the ſcale N° 3. the interval between the fifth and the ſixth of the key ſhould only be the tone leſſer: therefore the open ſecond ſtring is out of tune, being comma too ſharp. But A below upon the fourth ſtring being found as before, its octave, taken with the fourth finger upon the third ſtring, gives the note wanted, which is comma flatter than the open ſecond ſtring. See pages 36. 37.

SECOND STRING.

7th of the key, *B*. If the ſecond ſtring be ſtopped chord of ſixth greater above the open third ſtring, by the ſecond general inference, that ſtop gives the interval tone leſſer above the ſame ſtring open. By the regulation of A in the laſt article, that note is taken comma lower than the open ſecond ſtring; which is an addition to this interval equal to the difference between the tone leſſer and the tone greater: therefore the ſecond ſtring being ſtopped in chord of ſixth greater above the open third ſtring gives the true tune of B, the ſeventh of the key; which, by ſcale N° 3. is tone greater above the ſixth of the key.

Key-note, C. G being the fifth of the key, and the complement of the chord of fifth to octave being the chord of fourth; let G upon the third ſtring, taken as before, regulate the tune of C upon the ſecond ſtring; which laſt being ſtopped chord of fourth above the former, is in tune.

2*d of the key, D.* D upon the ſecond ſtring being ſtopped octave above the open third ſtring, which was ſhewn to be the true ſecond to the key-note below, becomes ſecond of the key.

3d of the key, E. Between A the ſixth of the key, counting upwards to E the third of the key, (ſee the ſcale N° 3.), is comprehended an interval of two tones greater, one tone leſſer, and one ſemi-tone, being the juſt chord of fifth. But the open ſecond ſtring was found to be comma too ſharp for A; therefore the open firſt ſtring is alſo, by the ſame quantity, too ſharp for E. Let, therefore, E upon the third ſtring be tuned as already directed, and take its octave with the fourth finger upon the ſecond ſtring for the true tune of this note, it ſhall be comma flatter than the open firſt ſtring. See pages 36. 37.

FIRST STRING.

4th of the key, F. C, the key-note, being taken as before upon the ſecond ſtring, ſtop F upon the firſt ſtring chord of fourth above it.

5th of the key, G. D upon the ſecond

ſtring being found as before, G upon the firſt ſtring muſt be ſtopped chord of fourth above it; becauſe D being the ſecond of the key, it is tone greater above the key-note: but ſubtracting a tone greater from the chord of fifth, the remainder is a chord of fourth, and G is the fifth of the key.

6th of the key, *A.* C is the key-note upon the ſecond ſtring; and being ſtopped as before, A, its ſixth, muſt be taken chord of ſixth greater above; for the open ſecond ſtring being falſe, this note muſt not be made octave to it.

7th of the key, *B.* B upon the ſecond ſtring being ſtopped as before, directs to its octave upon the firſt ſtring.

Key-note, *C.* C upon the ſecond ſtring being ſtopped as before, alſo directs to its octave upon the firſt ſtring.

D upon the ſecond ſtring being ſtopped as before, directs to its octave upon the firſt ſtring.

KEY MINOR A NATURAL.

SCALE N° 6. STAFF 3.

By Rule III. p. 49. it is required that the ſecond of the key major be flattened by comma, in order to become fourth of the key minor of the ſame ſignature; all the other notes of the key major being in true pitch for the key minor. By Rule IV. a ſixth and a ſeventh greater muſt alſo be tuned for the occaſional uſe of the minor. It would then be ſuperfluous to repeat the regulation of the degrees of tune common to both keys: therefore, leaving theſe to be found in the firſt ſtaff already prepared for the key major, we need only regulate theſe fourths in the third ſtaff for this minor key; and, for the reaſon already given, another ſtaff is added, for ſhewing the regulation of the ſixths and ſevenths greater.

The D's being the fourths of this leſſer mode A natural, their pitch may be found as follows:

FOURTH STRING.

4th of the key, *D*\`. In regulating the natural key of the greater mode, the tune of the open ſecond ſtring was found comma too ſharp; and therefore the tune of A for that key was taken comma flatter upon the third ſtring. Let this A upon the third ſtring be found as before; and this ſtop upon the third ſtring being tranſferred to the fourth ſtring, it will give D\` flatter by comma than the open tune of the third ſtring. The grave mark muſt be added for the reaſons already given, pages 50. 51.

SECOND STRING.

4th of the key, *D*\`. A upon the firſt ſtring, as regulated for the major mode, being octave to A upon the third ſtring for the ſame, which is comma flatter than the tune of the open ſecond ſtring; let the ſtop for A upon the firſt ſtring be taken as it ſtands in the firſt ſtaff of this ſignature, and let that ſtop be transferred to the ſecond ſtring; it muſt give D\` upon the ſecond ſtring comma flatter than as it ſtands regulated for the key major.

FIRST STRING.

*Fourth of the key, D`.* The laſt-mentioned D` upon the ſecond ſtring being found, and taken on a ſhift, directs to its octave upon the firſt ſtring. All theſe have the grave mark, to diſtinguiſh them from the pitch of the natural D's as they firſt ariſe in the key major.

FOURTH STRING. See Staff 4.

*※7th of the key, ※G`.* E, the fifth of the key minor, being found on the third ſtring, ſtop ※G` upon the fourth ſtring chord of ſixth leſſer below, becauſe the ſeventh greater is chord of ſixth leſſer below the fifth of every key; and add the grave mark. The reaſon is, that this ※G`, thus tuned, is not raiſed full limma major above the pitch of G, the difference between theſe notes being truly limma minor. See Part II. This may be proved by a method of calculation afterwards to

be given; which will ſhew, that all the ſharp ſixths and ſharp ſevenths of the minor keys ought alſo to be marked grave.

THIRD STRING.

※*6th of the key*, ※*F*ˋ. A, the key-note, being found upon the fourth ſtring, as in the firſt ſtaff of this ſignature, ſtop ※Fˋ upon the third ſtring chord of ſixth greater above it, and add the grave mark.

※*7th of the key*, ※*G*ˋ. The interval contained between the ſecond and ſeventh greater of any key (counting upwards from the ſecond) is equal to the chord of ſixth greater, as may be ſeen in the ſcale N° 3. where that interval contains two tones greater, two tones leſſer, and one ſemi-tone: therefore B, the ſecond of this key, being found upon the fourth ſtring as it is regulated in the firſt ſtaff of the ſignature, ſtop ※Gˋ upon the third ſtring chord of ſixth greater above; and this ſtop ſhall give the true ſeventh greater to this key minor.

FIRST STRING.

※*6th of the key*, ※*F*ˋ. By the Scale N° 3. the interval contained between the fourth and ſixth greater of any key (reckoning upwards from the fourth) is chord of third greater. Let, therefore, the fourth of this key, viz. Dˋ upon the ſecond ſtring, be found as before; and ſtop ※Fˋ upon the firſt ſtring chord of third greater above.

※*7th of the key*, ※*G*ˋ. By the Scale N° 3. the interval contained between the fifth and ſeventh greater above is equal to the chord of third greater. Let E, the fifth of this key, be found upon the ſecond ſtring, as before, (ſee ſtaff 1.), and ſtop ※Gˋ upon the firſt ſtring chord of third greater above.

KEYS WITH ONE SHARP.

SCALE N° 7.

The ſignature having a ſharp mark upon the place of F, which is the place of the ſeventh; and an acute mark upon the place of A, which is the place of the ſecond of this key.

KEY MAJOR with one SHARP.

See STAFF I.

F being the fourth of the preceding key major, and A being its ſixth, by Rule I. page 48. all the other notes of the preceding key major are in the tune of the preſent. The former of theſe, F, muſt be raiſed by limma major, to become of a proper pitch as ſeventh; and the latter, A, muſt be raiſed comma, to become a true ſecond to the preſent key.

Therefore, referring to the explanations already given of the tune of the other notes, and deſiring the reader to compare the Scale for the major key N° 6. with the Scale N° 7. notice ſhall now only be taken of thoſe notes of the key major N° 7. in which it differs from the former key major. The fourths natural, and the ſixths and ſevenths ſharp of the key minor, muſt likewiſe be adjuſted;

which will complete the examination of the Scale N° 7.: and ſo of every ſucceeding ſignature and its ſcales; the inveſtigation of the tune of which ſhall be referred to that of the preceding one, except in the notes to be altered.

FOURTH STRING.

2d of the key, A′. The tune of A upon the fourth ſtring in the preceding key major is regulated by the transferring a ſtop from the third ſtring, which was made chord of ſixth greater, to the open ſtring below. By the ſecond general inference, if A upon the fourth ſtring be now ſtopped chord of fourth below the open third ſtring, A′ thus ſtopped ſhall be comma ſharper than as it ſtood pitched for the preceding key major: therefore, by Rule I, page 48, A′ upon the fourth ſtring ſtopped chord of fourth below the open third ſtring is in true tune as ſecond to the preſent key; and it muſt have an acute mark, being comma ſharper than A of the natural key. This acute mark is placed in the ſignature, and muſt have a general influence over the key, in the ſame manner as the ſharp mark is allowed to have in common practice.

THIRD and SECOND STRINGS.

2d of the key, A'. A', the tune of the ſecond ſtring, was found to be comma too ſharp for the ſixth of the preceding key major; therefore it is now in true tune as ſecond of the preſent key: and counting upwards on the Scale N° 3. between the ſeventh greater and the ſecond, that interval is found to contain one tone greater and one ſemi-tone, being equal to the chord *7th of the key, ※F.* of third leſſer: therefore, if ※F, the ſeventh of this key, is ſtopped upon the third ſtring chord of third leſſer below the open ſecond ſtring, it ſhall become a true ſeventh to this key. That it is alſo the juſt elementary ſemi-tone below the key-note is plain; becauſe the interval between the key-note and the ſecond of the key is tone greater; the complement of which to the chord of third leſſer is ſemi-tone.

This ※F has no grave or acute mark affixed, being raiſed from the original F by a juſt interval of limma major; which is now underſtood to be repreſented preciſely by the ſharp, flat, and natural marks.

FIRST STRING.

7th of the key, ※F. The interval between the ſecond and the ſeventh greater, counting upwards from the ſecond, contains two tones greater, two tones leſſer, and one ſemi-tone; equal to the chord of ſixth greater. Let ※F upon the firſt ſtring be ſtopped chord of ſixth greater above the open ſecond ſtring; ※F thus ſtopped is therefore the true ſeventh of this key.

2d of the key, A′. The open ſecond ſtring being the true ſecond of this key, ſtop A′ upon the firſt ſtring octave above. A′ thus ſtopped muſt alſo be true ſecond to this key.

KEY MINOR E with one SHARP.
SCALE N°7. STAFF 3.

FOURTH STRING, and alſo THIRD and FIRST STRINGS.

4th of the key, A°. The ſeconds of the key major to be flattened comma, to render them true fourths to the key minor of this ſignature, are the A's; therefore theſe muſt be taken as they ſtand regulated for the key major of the former ſignature. This is done in the third ſtaff of the Scale N° 7. where the A's are regulated by the ſame ſtops as they were in the firſt ſtaff of N° 6. This may ſerve for a general rule while we proceed through the keys with ſharps.

FOURTH STRING. See Staff 4. of Scale 7.

※*6th of the key, ※C`*. The ſixth greater of any key being chord of third leſſer below the key-note; find, as in the Scales, the key-note E upon the third ſtring, and ſtop ※C` upon the fourth ſtring chord of third leſſer below, it is the true ſixth greater of this key.

THIRD STRING.

※7th of the key, *※Dˋ*. Find B the fifth of the key upon the fourth ſtring, and ſtop ※ Dˋ upon the third ſtring chord of third greater above; it is the ſeventh greater of the key: for, by Scale N° 3. the ſeventh greater is chord of third greater above the fifth of the ſame key.

SECOND STRING.

※6th of the key, *※Cˋ*. A°, the fourth of the key, being found by the Scales upon the third ſtring, ſtop ※Cˋ upon the ſecond ſtring chord of third greater above. ※Cˋ, thus ſtopped, is the true ſharp ſixth of the key.

7th of the key, *※Dˋ*. Find ※F, the ſecond of this key minor, upon the third ſtring, and ſtop ※Dˋ upon the ſecond ſtring chord of ſixth greater above it; for the ſharp ſeventh is chord of ſixth greater above the ſecond of every key.

FIRST STRING.

⋇*6th of the key*, ⋇*C*ˋ. Prepare ⋇Cˋ, as before, upon the ſecond ſtring, and take its octave upon the firſt ſtring.

⋇*7th of the key*, ⋇*D*ˋ. Alſo having prepared ⋇Dˋ, as before, upon the ſecond ſtring, take its octave upon the firſt ſtring.

KEYS WITH TWO SHARPS.

See SCALE N° 8.

KEY MAJOR D with two SHARPS.

STAFF I.

The ſignature is the ſharp mark continued upon the place of F, and another added upon the place of C, which laſt is the place of the ſeventh of this key; and the acute mark is continued upon the place of A, and likewiſe another acute mark added upon the place of E, which is the place of the ſecond of this key.

C being the fourth and E the ſixth of the preceding key major G with one ſharp, by Rule I. p. 48. theſe are the only notes wherein the preceding key major differs from the preſent, and which muſt undergo an alteration of their pitch.

THIRD and FOURTH STRINGS.

2d of the key, E′. E, the ſixth of the preceding key major upon the third ſtring, is tuned chord of ſixth greater above the open fourth ſtring. But the note E being ſecond to the preſent key, muſt, by the rule laſt quoted, be raiſed comma. By the ſecond general inference, this may be done by ſtopping it chord of fourth below the open ſtring above, as it is in this ſcale. The interval contained between the ſeventh major and the ſecond of any key, counting upwards from the ſeventh, being equal to the chord of third leſſer: let ✻C upon the fourth ſtring be ſtopped chord of third leſſer below this E′; and thus it is a true ſeventh to this key. See the Scale.

7th of the key, ✻C.

FIRST and SECOND STRINGS.

2d of the key, E′. In the former key

major G with one ſharp, the pitch of the firſt ſtring open was found to be comma too ſharp for the ſixth of that key: conſequently, by Rule I. p. 48. this pitch of tune muſt now be juſt as ſecond of the preſent key. And if ※C upon the ſecond ſtring be ſtopped chord of third leſſer below, according to the laſt article, it muſt alſo be a true ſeventh to this key.

7th of the key, ※*C.*

FIRST STRING.

7th of the key, ※*C.* A′ upon the firſt ſtring being ſtopped octave to the open ſecond ſtring, it is the fifth of this key; and if to an octave there be added the chord of third greater, it is called a *chord of tenth greater:* therefore, if the firſt ſtring be ſtopped chord of tenth greater above the open ſecond ſtring, it is the true ſeventh of this key.

KEY MINOR B with two SHARPS.

STAFF 3.

4th of the key, E°. The fourths of this key, the E°s, having been examined in the regulation of the key major of the preceding ſignature, to theſe reference is here made. They are marked with the negative ſign.

Fourth String. Staff 4.

⋇*6th of the key*, ⋇*G`*. E°, the fourth of the key, being found, as in the Scale, upon the third ſtring with the ſecond finger, with the firſt finger ſtop ⋇G` upon the fourth ſtring chord of ſixth leſſer below; for from the ſixth greater, counting upwards to the fourth of any key, there is an interval of ſixth leſſer, as may be ſeen upon the Scale N° 3.

⋇*7th of the key*, ⋇*A°*. ⋇F upon the third ſtring is the fifth of this key. Stop, therefore, ⋇A° upon the fourth ſtring chord of ſixth leſſer below, it is the true ſharp ſeventh of the key; for the ſharp ſeventh of any key is chord of ſixth leſſer below the fifth of that key.

Third String.

⋇*6th of the key*, ⋇*G`*. ⋇G` upon the fourth ſtring being found as before, ſtop ※Gˋ upon the third ſtring octave above.

SECOND STRING.

※*7th of the key*, ※*A*°. Find ※F, the fifth of this key upon the third ſtring, and with the firſt finger ſtop ※A° upon the ſecond ſtring chord of third greater above, it is the true ſeventh greater to this key; the ſeventh greater being chord of third greater above the fifth of any key.

FIRST STRING.

※*6th of the key*, ※*G*ˋ. Find E°, the fourth of the key, upon the ſecond ſtring; and ſtop ※Gˋ, chord of third greater above it, upon the firſt ſtring: ※Gˋ, thus ſtopped, is the true ſixth greater of the key; becauſe the interval between the fourth and the ſixth greater above is chord of third greater.

※*7th of the key*, ※*A*°. Find ※C, the ſecond of this key upon the ſecond ſtring; and the ſeventh greater of any key being chord of ſixth greater above its ſecond, ſtop ※A°

upon the firſt ſtring chord of ſixth greater above; and this ※A° muſt be a true ſharp ſeventh to the key.

KEYS WITH THREE SHARPS.

See SCALE N° 9.

The ſignature is the ſharp marks continued upon the places of F and C; and another added upon the place of G, the place of the ſeventh of this key. The acute marks are continued upon the places of A and E; and another added upon the place of B, the place of the ſecond of this key.

KEY MAJOR A′ with three SHARPS.

STAFF I.

FOURTH, and alſo THIRD and SECOND STRINGS.

The open firſt ſtring E′ is the fifth of this key, and B′ upon the ſecond ſtring its ſecond; the fifth of every key is acuter than the ſecond by the chord of fourth: *2d of the key, B′.* therefore if the ſecond ſtring be ſtopped in B′ chord of fourth below the open firſt ſtring, that ſtop is the ſecond of the key. The interval between the ſecond and the ſeventh greater of any key, counting downwards from the ſecond, *7th of the key, ※G.* is chord of third leſſer; ſtop ※G upon the third ſtring chord of third leſſer below this B′, and it is the true ſeventh of this key. Hold this laſt ſtop, and remove the firſt finger from the ſecond ſtring to the fourth ſtring; *7th of the key, ※G.* which being thereby ſtopped octave below ※G upon the third ſtring, it is alſo a true ſeventh to this key.

FOURTH STRING.

2d of the key, B′. E′ is the fifth of this key; and the interval between the fifth of a key and its ſecond downwards being chord of fourth, if the ſtop for E′ be taken upon the third ſtring, and the fourth ſtring alſo ſtopped in B′ chord of fourth below, that ſtop muſt be a true ſecond to the key.

THIRD STRING.

7th of the key, *✻G.* The regulation of ✻G upon the third ſtring, the ſeventh of this key, has been already examined in that of ✻G upon the fourth ſtring in the preceding page.

SECOND STRING.

2d of the key, *B′.* See the regulation of B′ upon the ſecond ſtring, preceding page.

FIRST STRING.

7th of the key, *✻G.* By the ſcale N° 3. the ſeventh of the major mode is chord of third greater above its fifth. The open firſt ſtring being the fifth of this key, ſtop the ſecond ſtring uniſon to the open firſt ſtring, and the firſt ſtring in ✻G chord of third greater above that uniſon upon the ſecond ſtring; ✻G upon the firſt ſtring, thus ſtopped, muſt be the true ſeventh of the key.

2d of the key, B′. See the regulation of ※G upon the fourth ſtring for the tune of B′ upon the ſecond ſtring, and its octave upon the firſt ſtring muſt alſo be a true ſecond to the key.

KEY MINOR of ※F with three Sharps.

Scale N°9. Staff 3.

4th of the key, B°. For the fourths of the key, which are the B°s, ſee the regulation of the B's of the key major of the preceding ſignature of two ſharps.

Third String.

※6th of the key, ※Dˋ. B°, the fourth of the key, being found, as before, upon the fourth ſtring, ſtop ※Dˋ upon the third ſtring chord of third greater above; for the ſixth greater is chord of third greater above the fourth.

※7th of the key, ※E°. In like manner, ※C upon the fourth ſtring being found, which

is the fifth of the key, ſtop ※E° upon the third ſtring chord of third greater above; for the ſeventh greater is chord of third greater above the fifth.

SECOND STRING.

※*6th of the key*, ※*D*ˋ. Find ※F, the key-note by the ſcale, upon the firſt ſtring, and ſtop ※Dˋ upon the ſecond ſtring chord of third leſſer below; for the ſixth greater is chord of third leſſer below the key-note.

※*7th of the key*, ※*E*°. The ſeventh greater being chord of third leſſer below the ſecond of the key, by the ſcales, find ※G upon the firſt ſtring, which is the ſecond of this key; and ſtop ※E° upon the ſecond ſtring chord of third leſſer below.

FIRST STRING.

※*6th of the key*, ※*D*ˋ. Find ※Dˋ upon the ſecond ſtring, as before directed, and take its octave upon the firſt ſtring.

KEYS WITH FOUR SHARPS.

SCALE N° 10.

The ſignature is the ſharp marks continued upon the places of F, C, and G, and another added upon the place of D, the place of the ſeventh of this key: the acute marks alſo are continued upon the places of A, E, and B, and another added upon the place of F, the place of the ſecond of the key.

KEY MAJOR E′ with four SHARPS.

STAFF 1.

FOURTH STRING.

7th of the key, ※*D.* B′ upon the ſecond ſtring is the fifth of this key; and the interval between the fifth and the ſecond below, of any key, being chord of fourth, *2d of the key,* ※*F′.* ſtop ※F′ upon the third ſtring chord of fourth below B′ ſtopped, as above, upon the ſecond ſtring; and it muſt be the true ſecond of this key.

But the ſeventh greater of any key is chord of third leſſer below its ſecond: therefore ſtop ※D, the ſeventh of this key upon the fourth ſtring, chord of third leſſer bebelow ※F′ ſtopped as before; and it is the true ſeventh of the key.

THIRD STRING.

2d of the key, ※F′. In finding ※D in the laſt article, the regulation of ※F′, the ſecond of this key, is pointed out.

SECOND STRING.

7th of the key, ※D. Let B′, upon the ſecond ſtring, the fifth of the key, be found; and this ſtop being transferred to the firſt ſtring, is chord of fifth to the ſaid B′.

2d of the key, ※F′. By page 29. the fifth above the fifth of a key is its ninth or ſecond. The ſeventh greater being chord of third leſſer below the ſecond of any key, ſtop the ſecond ſtring ſo as to give the chord of third leſſer below ※F′, found as above; and it muſt be ※D, the true ſeventh of the key.

First String.

2d of the key, ※F′. For the regulation of ※F′, the ſecond of the key upon the firſt ſtring, ſee the preceding article.

7th of the key, ※D. Take the octave of ※D, found, as before, upon the ſecond ſtring, for ※D, the ſeventh of the key upon the firſt ſtring.

KEY MINOR ※C with four Sharps.

Scale N° 10. Staff 3.

4ths of the key, ※F°s. Compare the regulation of the ※F°s, the fourths of this key, with that of the ※F's of the major of the preceding ſignature.

Fourth String.

※6th of the key, ※A°. ※F°, the fourth of this key upon the third ſtring, being found as above, ſtop ※A° upon the fourth ſtring chord of ſixth leſſer below it; for the ſharp ſixth is chord of ſixth leſſer below the fourth of any key.

※7th of the key, ※B°. Find ※G, the fifth of this key, as in the ſcales, upon the

third ſtring, and make ※B° upon the fourth ſtring chord of ſixth leſſer below. This ※B° is the ſeventh greater of the key, by Rule IV.

SECOND STRING.

※*6th of the key*, ※*A*°. ※F°, the fourth of this key upon the third ſtring, being found as above, ſtop ※A°, the ſixth greater upon the ſecond ſtring, chord of third greater above it.

※*7th of the key*, ※*B*°. ※G, the fifth of this key, being found upon the third ſtring, ſtop ※B° upon the ſecond ſtring chord of third greater above; it is the true ſeventh greater of this key.

FIRST STRING.

※6*th of the key*, ※*A*°. ※A° upon the ſecond ſtring being found as before, which is the ſixth greater to this key, take its octave upon the firſt ſtring.

※6*th of the key*, ※*B*°. Make ※B° upon the firſt ſtring octave to ※B° upon the ſecond ſtring, prepared as before.

KEYS WITH FIVE SHARPS.

SCALE N° 11.

The ſignature is the ſharp marks continued upon the places of F, C, G, and D, and another added upon the place of A, the place of the ſeventh of this key: the acute marks are alſo continued upon the places of A, E, B, and F; and another added upon the place of C, the place of the ſecond of this key.

KEY MAJOR B′ with five SHARPS.

STAFF I.

FOURTH STRING.

7th of the key, _*A′._ The ſeventh greater of any key is chord of ſixth leſſer below its fifth. Let *F′, the fifth of this key, be found upon the third ſtring, and ſtop *A′ upon the fourth ſtring chord of ſixth leſſer below; it is the true ſeventh of this key.

FOURTH

FOURTH STRING.

2d of the key, ※C′. Find ※F′ upon the third ſtring, which is the fifth of this key, and ſtop ※C′ upon the fourth ſtring chord of fourth below; it muſt be the true ſecond of this key.

SECOND STRING.

7th of the key, ※A′. The fifth of the key ※F′ upon the third ſtring being found as before, ſtop ※A′ upon the ſecond ſtring chord of third greater above; it is the true ſeventh of this key.

2d of the key, ※C′. The ſame ※F′ upon the third ſtring directs to ※C′ upon the ſecond ſtring; which being ſtopped chord of fifth above, is the true ſecond of this key.

FIRST STRING.

7th of the key, ※A′. ※D, the third of the key upon the ſecond ſtring, being found, and the interval between the third greater and the ſeventh greater being chord of f fifth, (ſee ſcale N°3.); find ※A′ upon he firſt ſtring, by transferring the ſtop or ※D from the ſecond to the firſt ſtring.

2d of the key, ※C′. ※C′, the ſecond of his key, being found, as before, upon the econd ſtring, its octave upon the firſt tring is the note wanted.

KEY MINOR ※G with five SHARPS.

STAFF 3.

4ths of the key, ※C°s. The fourths of his key being the ※C°s, the tune of theſe s regulated in the ſame manner with that f the ※C's of the key major of the pre- eding ſignature.

THIRD STRING. Staff 4.

6th of the key, ※E°. Find ※C°, the fourth of this key, as before, upon the fourth ſtring; and make ※E°, the ſixth greater upon the third ſtring, chord of third greater above.

*※7th of the key, *F°.* Find ※D upon the

fourth ſtring, being the fifth of this key; and make ✱F°, the ſeventh greater of this key upon the third ſtring, chord of third greater above.

SECOND and FIRST STRINGS.

✱*6th and* ✱*7th of the key*, ✱*E°* and ✱*F°*. The two laſt articles ſufficiently explain the pitch of theſe notes taken octave higher.

KEYS WITH SIX SHARPS.

SCALE N° 12.

The ſignature is the ſharp marks continued upon the places of F, C, G, D, and A; and alſo another added upon the place of E, the place of the ſeventh of this key. The acute marks are alſo continued upon the places of A, E, B, F, and C; and another added upon the place of G, the place of the ſecond of this key.

KEY MAJOR ※F′ with ſix SHARPS.

STAFF I.

THIRD and FOURTH STRINGS.

2d of the key, ※*G′*. ※C′, the fifth of this key upon the ſecond ſtring, being found by the ſcale, ſtop ※G′, the ſecond of this key upon the third ſtring, chord of fourth below it. ※G′ thus ſtopped is the true ſecond of the preſent key; and its octave below, taken upon the fourth ſtring, muſt alſo be true ſecond to the key.

THIRD STRING.

7th of the key, ※*E′*. ※C′ upon the fourth ſtring, which is the fifth of this key, being found as in the ſcale; and the interval between the fifth and the ſeventh greater being chord of third greater; ſtop ※E′ upon the third ſtring chord of third greater above ※C′ upon the fourth ſtring.

2d of the key, ※*G′*. The regulation of ※G′, the ſecond of this key upon the third ſtring, is ſhewn in that of ※G′ upon the fourth ſtring.

SECOND

SECOND STRING.

7th of the key, *※E′*. ※E′ upon the third ſtring being found as before, ſtop ※E′ upon the ſecond ſtring octave above it.

FIRST STRING.

2d of the key ※G′. ※C′ upon the ſecond ſtring being found, ſtop ※G′ upon the firſt ſtring chórd of fifth above it; for the ſecond of any key is always chord of fifth above its fifth.

KEY MINOR ※D with ſix SHARPS.

STAFF 3.

4ths of the key, *※G°s*. See the regulation of the ※G's in the key major of the preceding ſignature, which are of the ſame pitch with the ※G°s, the fourths of the preſent key minor.

FOURTH STRING. Staff 4.

※6th of the key, *※B°*. The ſixth greater of any key is chord of ſixth leſſer below its fourth. Find, therefore, ※G° upon the

third ſtring, and ſtop ※B° upon the fourth ſtring chord of ſixth leſſer below.

※*7th of the key*, ✱*C*°. Likewiſe the ſeventh greater of any key is chord of ſixth leſſer below its fifth. Find, therefore, ※A′ upon the third ſtring, which is the fifth of this key minor, and ſtop ✱C° upon the fourth ſtring chord of ſixth leſſer below.

SECOND STRING.

※*6th of the key*, ※*B*°. The ſame ſteps which direct to ※B° upon the fourth ſtring, direct alſo to ※B° upon the ſecond ſtring; only the laſt ſtep is taken a chord of third greater upwards, inſtead of the chord of ſixth leſſer downwards; for the chord of third greater, added to the chord of ſixth leſſer, are equal to octave.

※*7th of the key*, ✱*C*°. ※A′, the fifth of this key minor upon the firſt ſtring, being found, ſtop ✱C° upon the ſecond ſtring chord of ſixth leſſer below it; for the ſame reaſon given in the regulation of ✱C° upon the fourth ſtring.

First String.

※6th and ※7th of the key, ※B° and ✱C°. Theſe two notes, found upon the ſecond ſtring as before, direct to their octaves upon the firſt ſtring.

CHAP. VI.

Of pitching the key-note F′ for the key major with one flat, and hence deriving the regulation of all the keys with flats.

IN proceeding to regulate the keys of the violin with flats, it ſeems neceſſary to relax a little from the ſtrict uniformity, although not properly from the ſtrict accuracy, of tune, in the tranſition from the keys natural to thoſe with flats: and this by admitting the key-note of the key major F with one flat comma ſharper than the pitch of that note, as it ſtands fourth of the key major C natural.

Since all the keys with flats derive their pitch from F′, by this alteration all the notes of theſe keys with flats, though in perfect tune to each other, will ſtand comma ſharper than they would do if formed from the true pitch of the fourth of the key major C natural.

The reaſon is, that if the regular connection hitherto obſerved ſhould in this inſtance be rigidly purſued, and the key-note F be taken in the ſame pitch it holds in the natural key major, the regulation of the keys with flats would immediately run out of the reach of practice. This may be a ſufficient apology for ſuch a deviation, not properly productive of any falſe interval, but only of an irregularity in the formation of the keys.

Beſides what ſhall afterwards be ſaid to ſhew that compoſers have it in their power to modulate thro' this irregularity without admitting any falſe interval, it may be here obſerved, that the compoſer, or tranſpoſer of compoſition, has a range of fourteen keys natural and with ſharps, and of ten keys with flats; keeping within the limits of either of which, he leaves the violin-performer in poſſeſſion of rules which direct to perfect tune in the moſt regular connection; for the natural keys, and thoſe from one to ſix ſharps, are regularly connected. Theſe ſeven ſignatures, having each a major and a minor mode, afford a ſcope of fourteen regularly connected keys; and the ſignatures from one to five flats afford a ſcope of ten keys, alſo regularly connected.

KEYS WITH ONE FLAT.

SCALE N° 13.

By Rule II. page 49. if the fourth of a key be taken as a new key-note, from which another key is to be formed, the ſeventh of the given key muſt be flattened limma major, and the ſecond muſt be flattened comma, to adapt them to the tune of the new key. Therefore, in forming this key major with one flat from the key major

C natural, the ſeventh of the key natural, which is B, would receive the flat mark, and its ſecond, D, the grave mark: all the other notes would remain without any mark at all upon the ſignature on their places. But ſince the key muſt be pitched comma higher than it regularly ought, for the reaſon already given, in order to preſerve a clear idea of the pitch of tune, compared with that of the keys already regulated, D alone might be left unmarked, and the acute mark affixed to each of the other notes of the key. But it ſeems better to affix an acute mark to D, as well as to all the other notes; and to take off its effect again by adding the negative mark, in the ſame manner as muſt be done by the other notes in their courſe.

Thus the whole notes of this key, being comma higher than they ought, if uniformly connected with the keys already regulated, are in this manner marked; and therefore, inſtead of adding a grave mark to each ſucceeding ſignature order, an acute mark muſt be taken off. To do this, the beſt method ſeems to be to allow the acute marks to remain in their places, and to add the negative mark, where the uniformly connected ſyſtem of tune for the organ will have a grave mark.

KEY MAJOR F′ with one FLAT. SCALE N° 13. Staff 1.

THIRD STRING.

Key-note F′. F′, the key-note upon the third ſtring, is ſtopped chord of third greater below the open ſecond ſtring. This ſtop is comma higher than F, as it is regulated in the key major C natural: for the interval between the fourth, and the ſixth greater above, is equal to the chord of third greater; but A, the ſixth of the key major natural, was found to be comma flatter than the open ſecond ſtring; therefore F in the natural key major, which is chord of third greater below A of the ſame key, muſt

3d of the key, A′.

muſt be comma flatter than F′ when ſtopped chord of third greater below the open ſecond ſtring. The fourth of this key, however, has its flat mark, as well as it would have had if properly pitched to the former key; but it has alſo an acute mark, which it would not otherwiſe have had.

The whole tune of this key major muſt be particularly explained: becauſe the connection of tune with the natural keys being broken, prohibits reference to the tune of the key major of the preceding ſignature for the regulation of notes common to both; as hitherto has been done, and may afterwards be done when the firſt key major of this new pitch of tune has once been regulated.

FOURTH STRING.

w. The key-note F′ upon the third ſtring being pitched as above, the open ſecond ſtring is third to the key; and the interval between the third, and the ſeventh greater above, of any key major, being

2d of the key, G′.

chord of fifth, the open firſt ſtring is the true ſeventh to this key ſo pitched. But the interval between the ſecond, and the ſeventh greater above, being chord of ſixth greater; if G′ upon the third ſtring be ſtopped chord of ſixth greater below the uniſon of the firſt ſtring taken upon the ſecond ſtring, by the firſt general inference, page 32, G′ thus ſtopped is comma ſharper than G ſtopped octave to the open fourth ſtring; and its octave below muſt conſequently be comma higher than the open fourth ſtring. To ſtop the fourth ſtring juſt comma ſharper than the open ſtring, ſeems ſo exceedingly difficult, that it were better to conſider the inſtrument as wanting this note, than to attempt ſuch a ſtop: therefore, without regulating this note, the mark of reference (*w*) is affixed to it, to ſignify that defect.

It may here be aſked, If the open fourth ſtring, being falſe to this key, may not influence and miſlead the tune of the key, as well as it would do if falſe to the natural key major C, or to the key major G with one ſharp?

In the key major F with one flat, G is the ſecond of the key. The ſecond is always one of the leaſt characteriſtic notes belonging to a key, whilſt the key-note itſelf is the ground-note upon which all the reſt depend; and the fifth of the key is next in importance to the key-note itſelf. G is fifth to the natural key major, and key-note to the key major with one ſharp; the open fourth ſtring could not, therefore, without great diſadvantage, be made falſe to theſe keys. But, as ſecond to the key major with one flat, this loweſt note of the inſtrument may be well enough ſpared.

FOURTH STRING.

3d of the key, A′. The interval between the ſixth greater, and the third greater above, is chord of fifth. See Scale N° 3. The open ſecond ſtring being third to this key, the open third ſtring muſt therefore be ſixth to it; and the interval between the third, and ſixth greater above, being chord of fourth, if A′ upon the fourth ſtring be ſtopped chord of fourth below the open third ſtring, that ſtop is a true third to the key.

4th of the key, ♭*B′*. The open third ſtring, D°, has been found in the laſt article to be true ſixth of the key. But the fourth is always chord of third greater below the ſixth greater: ſtop, therefore, ♭B′ upon the fourth ſtring chord of third greater below the open third ſtring D°; and it is the true fourth of the key.

5th of the key, *C′*. The interval between the fifth, and third greater above, is chord of ſixth greater. Stop, therefore, C′ upon the fourth ſtring chord of ſixth greater below the uniſon of the open ſecond ſtring, taken upon the third ſtring; and that ſtop muſt be the true fifth to the key.

THIRD STRING.

6th of the key, *D°*. D°, the open third ſtring, has already been ſhewn to be the true ſixth of this key.

7th of the key, E′. The interval between the ſeventh greater, and the third greater above, is chord of fourth; if therefore E′ upon the third ſtring be ſtopped chord of fourth below the open ſecond ſtring, it ſhall be a juſt ſeventh to this key.

Key-note F′. The tune of the key-note F′ upon the third ſtring has already been ſhewn, page 102.

2d of the key, G′. For the regulation of G′ upon the third ſtring, ſee page 104.

SECOND STRING.

3d of the key, A′. For A′, the open ſecond ſtring, which is the third of this key, ſee page 102.

4th of the key, ♭B′. The interval between the ſixth greater, and the fourth above, is chord of ſixth leſſer: if, therefore, ♭B′ upon the ſecond ſtring be ſtopped chord of ſixth leſſer above the open third ſtring, it is in juſt tune to this key.

5th of the key, C′. The open firſt ſtring was ſhewn, page 104, to be the true ſeventh to this key; but the interval between the fifth, and the ſeventh greater above, is chord of third greater: if, therefore, C′ upon the ſecond ſtring be ſtopped chord of third greater below the open firſt ſtring, it muſt be the true fifth of the key.

6th of the key, D°. D°, the ſixth of the key upon the ſecond ſtring, is found by ſtopping that ſtring octave to the open third ſtring, which was already ſhewn to be the ſixth of the key.

FIRST STRING.

7th of the key, E′. The open firſt ſtring was ſhewn already to be the true ſeventh of the key. See page 104.

Key-note F′. The open ſecond ſtring being the third of the key, and the complement of the third greater to the octave being chord of ſixth leſſer; if F′ upon the firſt ſtring be ſtopped chord of ſixth leſſer above the open ſecond ſtring, it is octave to F′, the key-note, as before, upon the third ſtring.

2d of the key, G′. The interval between the ſeventh greater, and the ſecond of the key above, is chord of third leſſer: if, then, the uniſon of the firſt ſtring open be taken upon the ſecond ſtring, and G′ be ſtopped upon the firſt ſtring chord of third leſſer above, G′ ſo taken is the ſecond of the key.

3d of the key A′. Stop A′ upon the firſt string octave above A′ the open ſecond ſtring, it ſhall be a true third to the key.

4th of the key ♭B′. ♭B′ upon the ſecond ſtring being found as before, if ♭B′ upon the firſt ſtring be ſtopped octave above, it muſt alſo be a true fourth of the key.

5th of the key C′. A′ the ſecond ſtring open is the third of this key, and the interval between the third, and the fifth of the key above, is chord of third leſſer; but the chord of third leſſer, added to an octave, is chord of tenth leſſer: if, therefore, C′ upon the firſt ſtring be ſtopped chord of tenth leſſer above the open ſecond ſtring, it is in tune.

6th of the key, D°. D° upon the ſecond ſtring being found as before, its octave upon the firſt ſtring is in tune as ſixth of the key.

KEY MINOR D° with one FLAT.

SCALE 13. Staff 1.

By Rule III. p. 49. the ſeconds of the key major muſt be flattened comma, that they may become true fourths to the minor of the ſame ſignature.

FOURTH STRING.

4th of the key, G°. The ſeconds of the key major to be flattened comma, being the G's; and the open fourth ſtring having been found comma too flat for the pitch of G′ in the key major, it is of courſe in the juſt pitch of tune for G°, the fourth of the key minor.

THIRD STRING.

4th of the key, G°. The third ſtring ſtopped octave above the open fourth ſtring muſt alſo be in true tune for G° in this key.

First String.

4th of the key, G°. D°, the ſixth of the key major, and key-note of the preſent key minor, being found, as in the Scale, upon the ſecond ſtring, ſtop G° upon the firſt ſtring chord of fourth above.

Fourth String. Staff 4.

※6th of the key, ♮B°. The interval between the fourth, and the ſixth greater of any key below, being chord of ſixth leſſer; find G°, the fourth of this key upon the third ſtring, and ſtop ♮B°, its ſixth greater upon the fourth ſtring, chord of ſixth leſſer below.

※7th of the key, ※C°. The interval between the fifth of any key, and its ſeventh greater below, being chord of ſixth leſſer, ſtop ※C° upon the fourth ſtring chord of ſixth leſſer below the uniſon of the open ſecond ſtring, which is the fifth of the key.

Second

SECOND STRING.

※*6th of the key*, ♮*B°*. ♮B° upon the ſecond ſtring is taken, in the Scales, as chord of ſixth greater above the open third ſtring, which laſt is the key-note; therefore ♮B° thus ſtopped muſt be the ſharp ſixth of the key.

※*7th of the key*, ※*C°*. The interval between the ſeventh greater of any key, and its ſecond above, is chord of third leſſer; and the firſt ſtring open being the ſecond of this key, if ※C° upon the ſecond ſtring be ſtopped chord of third leſſer below the open firſt ſtring, it is a true ſeventh greater to this key.

FIRST STRING.

※*6th and* ※*7th of the key*, ♮*B° and* ※*C°*. ♮B° and ※C° upon this ſtring, being ſtopped octave above the former ♮B° and ※C° upon the ſecond ſtring, they are the true ſixth and ſeventh greater to this key.

KEYS WITH TWO FLATS.

SCALE N° 14.

The ſignature is the flat mark continued upon the place of B, and another added upon the place of E, the place of the fourth of the preſent key major. The negative mark is alſo continued upon the place of D, and another added upon the place of G, the place of the ſixth of the preſent key major.

KEY MAJOR ♭B′ with two FLATS.

STAFF I.

FOURTH STRING.

6th of the key, G°. The ſecond of the preceding key major being comma ſharper than the tune of the open fourth ſtring, by Rule II. page 49. the open fourth ſtring is a true ſixth to this key.

THIRD STRING.

4th of the key, ♭E′. The open fourth

ſtring being ſixth of this key, the open third ſtring muſt be third to it; and the chord of ſixth leſſer being compounded of the chord of fifth and ſemi-tone, ſtop ♭E′ upon the third ſtring chord of ſixth leſſer above the open fourth ſtring; and the difference between that ſtop and the open third ſtring muſt be ſemitone. ♭E′ thus ſtopped is therefore true fourth to the key.

6th of the key, *G°*. G° upon the third ſtring, ſtopped octave above the open fourth ſtring, muſt be ſixth of the key; for the open fourth ſtring has been ſhewn to be ſixth of the key.

SECOND STRING.

4th of the key, *♭E′*. ♭E′ upon the ſecond ſtring ſtopped octave above the former ♭E′ upon the third ſtring, muſt alſo be the fourth of the key.

FIRST STRING.

6th of the key, *G°*. The interval between the third greater, and the ſixth greater above, being chord of fourth, find D°, the third of this key upon the ſecond ſtring, and ſtop G° upon the firſt ſtring chord of fourth above.

KEY MINOR G° with two FLATS.

SCALE N° 14. Staff 3.

FOURTH STRING.

4th of the key, *C°*. Find G° upon the third ſtring, which is the key-note, and ſtop C° upon the fourth ſtring chord of fifth below, it is the true fourth of this key minor.

SECOND STRING.

4th of the key, *C°*. G° upon the third ſtring, which is the key-note, being found, ſtop C° upon the ſecond ſtring chord of fourth above.

FIRST STRING.

4th of the key, *C°*. C° upon the firſt ſtring muſt be taken octave above C° upon the ſecond ſtring, found as before.

THIRD STRING.

※*6th of the key*, ♮*E°*. Stop ♮E° upon the third ſtring chord of ſixth greater above the key-note or open baſs.

※*7th of the key*, ※*F°*. Stop ※F° chord of third leſſer below the open ſecond ſtring, which is ſecond of the key. ※F° thus ſtopped is the true ſeventh greater to the key, for the reaſons often already aſſigned.

SECOND STRING.

※*6th of the key*, ♮*E°*. Find ♮E°, the ſixth greater of this key upon the third ſtring, as before directed, and take its octave upon the ſecond ſtring.

FIRST STRING.

※*7th of the key*, ※*F°*. Find D° upon the ſecond ſtring, which is the fifth of this key, and make ※F° upon the firſt ſtring chord of third greater above.

KEYS WITH THREE FLATS.

SCALE Nº 15.

The ſignature is the flat marks continued upon the places of B and E, and another added upon the place of A, the place of the fourth of the key. The negative marks are likewiſe continued upon the places of D and G, and another added upon the place of C, the place of the ſixth of the key.

KEY MAJOR ♭E′ with three FLATS.

STAFF I.

FOURTH STRING.

4th of the key, ♭*A′*. Find ♭E′ upon the third ſtring, which is the key-note, and ſtop ♭A′ upon the fourth ſtring chord of fifth below. ♭A′ thus ſtopped is the true fourth of the key.

6th of the key, *C°*. Find G° upon the third ſtring, which is the third of the

preſent

preſent key, and ſtop C° upon the fourth ſtring chord of fifth below; for the ſixth is always chord of fifth below the third of the major mode.

THIRD STRING.

4th of the key, ♭A′. ♭A′ upon the fourth ſtring being found as before, ſtop ♭A′ upon the third ſtring octave to it.

SECOND STRING.

6th of the key, C°. Find G°, the third of the key upon the third ſtring, as in the Scale; and the interval between the third greater, and the ſixth greater above, being chord of fourth, ſtop C° upon the ſecond ſtring chord of fourth above G° ſo found.

FIRST STRING.

4th of the key, ♭A′. ♭E′, the key-note, being found, as in the Scale, upon the ſecond ſtring, ſtop ♭A′ upon the firſt ſtring chord of fourth above.

6th of the key, C°. C° upon the ſecond ſtring being found as before, ſtop C° upon the firſt ſtring octave above.

KEY MINOR C° with three FLATS.

STAFF 3.

THIRD STRING.

4th of the key, *F°*. C°, the key-note upon the fourth ſtring, being pitched as it ſtands in the key major of this ſignature, ſtop F° upon the third ſtring chord of fourth above it.

FIRST STRING.

4th of the key, F°. F° upon the third ſtring being thus found, F° upon the firſt ſtring, made octave above, muſt be in tune. But as theſe cannot be ſtruck in conſonance, this octave may be found by aſcending the ſteps of fifth and of fourth, as in the Scale.

FOURTH STRING. Staff 4.

♯6th of the key, ♮*A°*. Find F°, the fourth

of this key, upon the third ſtring, as before, and make ♮A°, the ſixth greater of the key upon the fourth ſtring, chord of ſixth leſſer below it; becauſe the ſixth greater is chord of ſixth leſſer below to the fourth of the ſame key.

※*7th of the key*, ♮*B*°. The open third ſtring is the ſecond of this key; therefore ♮B° upon the fourth ſtring, ſtopped chord of third leſſer below it, is the ſeventh greater of the key.

THIRD STRING.

※*6th of the key*, ♮*A*°. Find the key-note C° upon the fourth ſtring, and ſtop ♮A° upon the third ſtring chord of ſixth greater above.

SECOND STRING.

※*7th of the key*, ♮*B*°. The interval between the ſecond, and the ſeventh greater above, is chord of ſixth greater: ſtop, therefore, ♮B° upon the ſecond ſtring chord of ſixth greater above the open third ſtring;

this ſtop gives the true ſeventh greater to the key.

FIRST STRING.

※*6th of the key* ♮*A*°. Find the key-note upon the ſecond ſtring, and ſtop ♮A° upon the firſt ſtring chord of ſixth greater above.

※*7th of the key*, ♮*B*°. And make ♮B° upon the firſt ſtring octave to ♮B° upon the ſecond ſtring.

KEYS WITH FOUR FLATS.

See SCALE N° 16.

The ſignature is the flat marks continued upon the places of B, E, and A, and another added upon the place of D, the place of the fourth of this key; and alſo the negative marks continued upon the places of D, G, and C, and another added upon the place of F, the place of the ſixth of this key.

KEY MAJOR ♭A′ with four FLATS.

SCALE N° 16. Staff 1.

FOURTH STRING.

4th of the key, ♭*D*°. Find ♭A′ upon the third ſtring, which is the key-note, and ſtop ♭D° upon the fourth ſtring chord of fifth below it; ♭D° thus ſtopped is the true fourth of the key.

THIRD STRING.

6th of the key, *F*°. Find C° upon the fourth ſtring, which is the third of the key, and ſtop F° upon the third ſtring chord of fourth above it: F° thus ſtopped is the true ſixth of this key.

SECOND STRING.

4th of the key, ♭*D*°. ♭A′ upon the third ſtring being the key-note, ſtop ♭D° upon the ſecond ſtring chord of fourth above it: ♭D° thus ſtopped is the true fourth of the key.

FIRST STRING.

6th of the key, F°. C°, the third of this key, being found upon the ſecond ſtring, directs to F° upon the firſt ſtring; which laſt being ſtopped chord of fourth above the former, is true ſixth of this key.

4th of the key, ♭D°. From ♭D°, regulated, as above, upon the ſecond ſtring on a ſhift, its octave on the firſt ſtring may be found.

KEY MINOR F° with four FLATS, STAFF 3.

FOURTH STRING.

4th of the key, ♭B°. Find F°, the key-note upon the third ſtring, and ſtop ♭B° upon the fourth ſtring chord of fifth below it: ♭B° thus ſtopped is the true fourth of this key minor.

SECOND STRING.

4th of the key, ♭B°. F°, the key-note upon the third ſtring, directs to ♭B° upon the ſecond ſtring, to be ſtopped chord of fourth above it.

FIRST STRING.

`*4th of the key*, ♭B°. ♭B° upon the firſt ſtring is found by taking it octave directly to ♭B° upon the ſecond ſtring, found as before.

FOURTH STRING. Staff 4.

※*6th of the key*, ♮*D*`. Find the key-note upon the third ſtring, and ſtop ♮D` upon the fourth ſtring chord of third leſſer below it.

THIRD STRING.

※*7th of the key*, ♮*E*°. The open fourth ſtring is the ſecond of this key minor, and the interval between the ſecond, and ſeventh greater above, is chord of ſixth greater. Stop, therefore, ♮E° upon the third ſtring chord of ſixth greater above the open fourth ſtring, and it is true ſeventh greater of this minor key.

Second String.

※*6th of the key*, ♮*D*ˋ. Find the key-note upon the third ſtring, and ſtop ♮Dˋ upon the ſecond ſtring chord of ſixth greater above it.

※*7th of the key*, ♮*E*°. Let ♮E° upon the ſecond ſtring be taken octave to ♮E° already found upon the third ſtring.

※*6th of the key*, ♮*D*ˋ. ♮Dˋ upon the firſt ſtring may be found by making it octave above ♮Dˋ already found upon the ſecond ſtring.

KEYS WITH FIVE FLATS.

Scale N° 17.

The ſignature is the flat marks continued upon the places of B, E, A, and D; and another added upon the place of G, the place of the fourth of this key: alſo the negative marks continued upon the places of D, G, C, and F; and another added upon the place of B, the place of the ſixth of this key.

KEY MAJOR ♭D° with five FLATS.

SCALE N° 17. Staff 1.

FOURTH STRING.

%. The open fourth ſtring being the ſeventh of the key major ♭A′ with four flats, ſhould be flattened limma major, to make it true fourth to the preſent key; but this is beyond the reach of the fiddle; and therefore the mark of reference is put in its place, to ſhew that it is wanting.

6th of the key, ♭*B*°. Find F°, the third of this key on the third ſtring, and ſtop ♭B° upon the fourth ſtring chord of fifth below it: ♭B° thus ſtopped is true ſixth of the key.

THIRD STRING.

4th of the key, ♭*G*°. Find the key-note ♭D° upon the fourth ſtring, and ſtop ♭G° upon the third ſtring chord of fourth above it.

SECOND STRING.

6th of the key, ♭*B*°. F°, the third of this key, being found on the third ſtring, directs to ♭B° upon the ſecond ſtring; which laſt being ſtopped chord of fourth above the former, is true ſixth of this key.

FIRST STRING.

4th of the key, ♭*G*°. Find the key-note upon the ſecond ſtring, and ſtop ♭G°, the fourth of the key upon the firſt ſtring, chord of fourth above it.

6th of the key, ♭*B*°. Find ♭B° upon the ſecond ſtring, and ſtop ♭B° upon the firſt ſtring octave above the former; it is true ſixth of the key.

KEY MINOR ♭B° with five FLATS.

STAFF 3.

THIRD STRING.

4th of the key, ♭*E*°. Find ♭B°, the key-note upon the the fourth ſtring, and ſtop ♭E° upon the third ſtring chord of fourth above it: ♭E° thus ſtopped is true fourth of this key.

SECOND STRING.

4th of the key, ♭*E°*. Find ♭E°, as before, on the third ſtring, and ſtop ♭E° upon the ſecond ſtring octave above the former.

FOURTH STRING.

※*7th of the key*, ♮*A°*. Find F°, the fifth of this key on the third ſtring, and ſtop ♮A° upon the fourth ſtring chord of ſixth leſſer below; it is true ſeventh greater of this key.

THIRD STRING.

※*6th of the key*, ♮*G`*. Find the key-note upon the ſecond ſtring, and ſtop ♮G` upon the third ſtring chord of third leſſer below it; it is true ſixth greater of this key.

※*7th of the key*, ♮*A°*. Find ♮A°, the ſharp ſeventh of this key upon the fourth ſtring, as before directed, and ſtop ♮A° upon the third ſtring octave above it.

FIRST STRING.

※*6th of the key*, ♮*G*`. Find ♭B°, the key-note upon the ſecond ſtring, and ſtop ♮G` upon the firſt ſtring chord of ſixth greater above.

※*7th of the key*, ♮*A*°. Find ♮A° upon the third ſtring, as directed above, and from it aſcend to ♮A° upon the firſt ſtring by the chords of fifth and fourth.

Theſe ſcales, or rather thoſe among them which have their ſignatures much crowded with marks, are not contrived ſo much with a view to practice, as to ſhew, in the moſt evident manner, the connection of tune. Upon that account, there are ſeveral ſteps admitted into many of the regulations which might be ſet aſide; and hence the trial of tune, in theſe particular caſes, would be greatly facilitated. For example, ♮A°, the ſharp ſeventh of the key minor with five flats upon the firſt ſtring, has no leſs than ſeven preparatory chords, which may be reduced to three, as it is ſhewn in an annexed regulation of that note. This is found by a method of calculation, which ſhall be afterwards uſed in treating of the tune of the organ; but of which we cannot now avail ourſelves, whilſt the regulation of tune for the fiddle in each key is derived from that of the preceding key. The keys commonly in uſe are very ſimple and practicable.

It ſeems unneceſſary to carry theſe ſcales higher than the pitch of D, upon what is commonly called the *full ſhift*; for when theſe are well underſtood, performers will of themſelves know how to put in practice what remains. The methods of taking the higher ſhifts being ſo exceedingly various, it would be endleſs to attempt to regulate them; nor, without much trouble and explanation, could a few examples be underſtood by thoſe who cannot now of themſelves apply what has been ſhewn to new caſes.

It ſeems agreed amongſt people of good taſte, that performance upon the higher ſhifts ſerves chiefly to excite admiration of dexterity, often at the expence of true muſical ſentiment. It were to be wiſhed that performers would rather direct their attention towards the attainment of true tune; and in this department a field almoſt boundleſs for exerciſe ſeems to lie before us.

CHAP. VII.

Of the advantages ariſing from the regulated ſcales; and of the capacity of the ear.

HAVING examined the tune of the treble fiddle in all its keys, admitting a ſingle deviation only from the uniformity of connection; to ſhew the neceſſity of this, the reader may be informed, that an attempt has been made to purſue the regular connection of tune from the natural keys to the keys with four ſlats; but the multiplicity of ſteps neceſſary to be interpoſed, before the tune of any note required can be found, in the keys with flats thus regulated, ſeems a ſufficient reaſon for rejecting them.

What appears of ſtill greater conſequence is, that ſuch a regulation leads off from all immediate connection with the tune of the open ſtrings. For although theſe are ſeldom uſed alone in good performance; yet having their tune to appeal to as directing our departure, and frequently alſo having occaſion to uſe them as uniſon, or ſome other concord, to a ſtopped note, they become a great ſecurity when true to the key; but when falſe, eſpecially if the difference be ſmall, they cannot fail to miſlead. And it will preſently appear, that the greateſt maſters have been miſled by them to the extent of comma at leaſt; the effect of which, when examined by the experiments already propoſed, will give an idea of the errors exiſting, and frequently occurring in the very beſt performances: ſhewing alſo how far the ear will ſuffer itſelf to be impoſed upon; nay, that it will ſeem to reliſh, and even to be delighted with muſical performance, in ſpite of ſuch and much greater blemiſhes, notwithſtanding of its capacity to diſtinguiſh with the utmoſt preciſion.

Take a piece of braſs wire; ſoften it in the fire, which will fit it to retain any ſhape into which it may be moulded; roll it round any thing of a cylindric form, about the thickneſs of the fore-finger; and taking it off, draw it a little to length, and it will take a ſpiral form. Put it upon the firſt joint of the fore-finger, and draw forward the end neareſt the point of the finger. See Plate VIII. fig. 18.

Take a well-tuned fiddle, and, applying the hand in the ordinary way, gently put the end of the wire below any of the ſtrings; but the higher ones give the more diſtinct trial. Then, according to any of the propoſed experiments at the beginning, make trial by ſliding the wire higher and lower upon the finger-board, the finger gently preſſing down the ſtring upon the wire as upon a frett, and attending accurately to the tune of the two ſtrings ſounding, till the ear is ſatisfied that the concord is perfect; perceiving that all beatings and wavings have ceaſed, and that the third tone produced by the two ſounds, and firſt noticed by the celebrated *Tartini*, is heard pure and diſtinct. Then let an aſſiſtant mark the ſpot with a needle's point where the part of the wire acting as a frett croſſes the ſtopped ſtring, making a ſmall puncture upon the finger-board. After the puncture is thus made, withdraw the wire from below the ſtring, and try if the fiddle has kept its firſt tune without alteration. Then proceed after the like manner to perform the other part of the ſame experiment for tuning comma; and the diſtance betwixt the two punctures will appear to be very conſiderable. If, after repeated trials, (the diſtance between the nut and the bridge being carefully made the ſame as before), it ſhall be found that the punctures do always nearly, and often exactly, coincide with thoſe made in the firſt trial; who can doubt of the exquiſite diſcernment of which the ear is poſſeſſed? And when the difference of comma (which has hitherto been unattended to in practice) is thus exhibited both to the ear and eye; who can doubt of the great inaccuracy of our muſical performances, or of the high improvements of which they are capable?

A doubt has been expreſſed of the conſtant coincidence of the punctures; becauſe although, under very favourable circumſtances, they will often ſucceſſively coincide for a great number of trials, yet this cannot always happen. The minute inequalities upon the ſurfaces of the ſtrings always more or leſs affect the tone with ſome degree of imperfection. Such ſtrings as are now uſed are very ſubject to alteration, and never for a moment continue perfectly ſteady in the ſame degree of tenſion. The ſtate of the air has a remarkable effect upon them, eſpecially if the weather be moiſt; and it frequently happens, that ſome conderable time is ſpent in aſcertaining the point of true tune. But above all, inequalities in the ſhape and thickneſs of the ſtrings are unfavourable. Theſe, and a thouſand other circumſtances which muſt occur in every trial, are more than ſufficient to account for ſmall variations that ſometimes happen in the ſituation of the needle's point.

It may be recommended to the performer upon the violin to have a copy of the regulated ſcales lying before him when he goes to practiſe; and for ſome time at leaſt, till he become well acquainted with them, he ſhould, before entering upon the practice of any piece of muſic, frequently go through the tune of the ſcale which regulates its principal key, till he find he can readily recollect the pitch of every note belonging to it.

When he proceeds to practice, however laborious, yet if he deſire to excel, he muſt not neglect to ſtudy every paſſage ſeparately, and to repeat it a thouſand times; ſometimes ſtopping at one note, ſometimes at another, to examine the tune and to correct errors.

Great attention muſt likewiſe be paid to the changes of key, and other circumſtances afterwards to be explained, which often occur in the progreſs of a compoſition. And indeed theſe ſhould be particularly marked by compoſers and writers of muſic: for whenever the key is changed, or any other circumſtance occurs requiring an alteration of the pitch of tune, the manner of taking the tune muſt be changed alſo. The ſcale which regulates the tune of the new key, or which directs to the tune required by other circumſtances, muſt be followed as a guide, till the compoſition return to the former pitch, or modulate into another key.

Let not the appearance of difficulty make the learner deſpair altogether of ſucceſs. For a continued attention to the ſcales will enable the hand to attain great accuracy, though ſeldom anſwerable to the full demand of the ear, yet to ſuch a degree as will greatly improve the tune of the very beſt performer.

For, as it has been ſaid, it is not to be hoped that ever the hand will be formed, even by the cloſeſt attention to theſe ſcales, ſo as ſteadily to ſtrike the perfect tune contained in them. But it is a happy condition of humanity, that although it can very ſeldom reach even the limited degree of perfection we ſpeak of; yet ſtill it can be pleaſed, nay delighted, in proportion to the degree of approach it makes; otherwiſe we might ſit down with hands acroſs, and give up the purſuit.

That muſic, as hitherto practiſed, is not only delightful, but raviſhing, none who have heard fine compoſition, executed in the maſterly manner we now often hear it, and poſſeſſed of an ordinary capacity for enjoying it, will deny: but that even the beſt performances are exceedingly imperfect, can be proved beyond contradiction.

We have ſeen how palpably ſhocking the error of comma is, when deliberately attended to, in the experiments upon tune already made. However this may paſs in the hurry of performance, yet it moſt certainly has its influence, and renders many a paſſage that would otherwiſe be delightful, at leaſt indifferent, if not diſagreeable. For confirmation of this, we appeal to the judgment of an experienced ear, attending accurately to what paſſes in a concert of the beſt performers.

That the tune of the organ, harpſichord, and all inſtruments with fixed notes, as they are ſeverally conſtructed, is falſe, is known and acknowledged; nay, were they actually tuned perfectly agreeable to the plan of the ingenious Mr Smith, no two notes of the whole inſtrument would be in juſt tune, and very many of them would be falſe to the extent of comma at leaſt. For it ſhall be ſhewn, that there is a natural divergency of pitch in almoſt every note, which, when the whole twenty-four keys are perfectly arranged, amounts to no leſs than double comma; and therefore, however this might be tempered by a medium pitch of tune, there would ſtill remain errors equal to comma.

But it is plain, that the errors of the preſent inſtruments muſt be often much greater than comma, ſince no one pretends to be able practically to tune a ſyſtem of tempered notes ſo as to divide the errors equally over the whole.

It may, however, ſeem more difficult to convict a violin-performer of ſuch errors; for it muſt be acknowledged, that the inſtrument is capable of perfect tune, as has been ſhewn. But the queſtion is, Whether ever in fact perfect tune has been performed upon it? There is reaſon to think it has not; and that the errors of the beſt performers are very frequently not leſs, but ſtill greater than thoſe found in fixed inſtruments.

Probably it will not be denied, that every violin-performer means to derive the pitch of his tune from the tune of the open ſtrings in general; elſe, why tune his fiddle to the pitch of other inſtruments

ments with which he is to perform in concert? or indeed why tune it at all?

It ſeems likewiſe probable, that in performing any piece of muſic in the natural key major C, he means to take the tune of the fourth ſtring as fifth of the key, and that of the open third ſtring as ſecond of the key. If ſo, then the open ſecond and open firſt ſtrings are both out of tune to this key; and the error is comma. And if, in ſuch circumſtances, a performer ever admit the tune of theſe open ſtrings, or their uniſons, he is unqueſtionably out of tune by comma.

There is no diſputing with a nimble-fingered performer, upon what happens during performance. We may ſay, that we feel his errors; and he will anſwer, that it is affectation to ſay ſo. The appeal then muſt be made to ſomething more permanent than the fleeting perception of a note as it paſſes in the act of performance; and fortunately, or rather unfortunately, there is large ſtore of errors in the compoſitions of the greateſt maſters. There ſhall only be given three examples; but theſe taken from the works of the moſt eminent muſicians.

TARTINI's SOLOS, *Opera 1ma, ſonata 3za, motiva 2da, allegro.* Through the whole of this movement, it is plain, that the tune of the open firſt and ſecond ſtrings is frequently meant to be admitted; but we ſhall quote a few paſſages for all. Laſt crotchet of the ſecond bar, Plate VIII. fig. 27.; firſt crotchet of the ninth bar, fig. 28.; ſixth bar of the ſame, fig. 29. In the two firſt of theſe paſſages, we have the tune of the open firſt and ſecond ſtrings, neceſſarily admitted into the tune of the natural key major. For, in the ſecond bar, while C is ſtopped upon the ſecond ſtring, E above it, cannot be taken in any pitch lower than the tune of the open firſt ſtring; nor, in the ninth bar, can A be brought into conſonance with G in any pitch lower than the open ſecond ſtring. In the ſixth bar, although it is improbable that Tartini meant any thing elſe than that the tune of the third and fourth ſtrings open ſhould be uſed in the two firſt crotchets; yet the third puts it beyond all queſtion. For it cannot be ſuppoſed that he there means to uſe the firſt finger upon the fourth ſtring to raiſe the tune comma higher, the ſecond finger for E upon the third ſtring, and the third or fourth finger upon the ſecond ſtring for C; which nevertheleſs muſt be done if he meant to execute theſe paſſages in true tune, conſiſtent with the others. For it has been ſhewn, that if the key be ſo pitched, that the tune of the open third and fourth ſtrings belongs to it, the tune of the open firſt and ſecond ſtrings is too ſharp by comma; and conſequently, that if the key were pitched ſo as to render the open firſt and ſecond ſtrings in tune to it, the open third and fourth ſtrings muſt then be falſe by the like quantity.

Corelli's Solos, *Opera 5ta, ſonata 3za, motiva 2da, allegro.* Through the whole of this movement alſo, it is clear, that the tune of the open firſt and ſecond ſtrings is meant to be admitted; eſpecially beyond all diſpute in in the laſt bar, (fig. 30.), where the cloſing chord, which is ſurely meant to be the perfect harmony of the key-note, cannot be performed upon the violin without admitting the open tune of the firſt ſtring.

I have none of Giardini's works at preſent, except ſix ſolos; where he has been ſo ſparing of double notes, that there is little opportunity of getting examples. However, in the third movement of his ſecond *ſonata*, *andante*, *grazzioſo*, bar 4th, (fig. 31.) it cannot be thought he meant otherwiſe than that the open tune of the firſt ſtring ſhould be admitted.

All theſe examples are taken from the key major natural; becauſe, having explained the falſity of the tune of theſe open ſtrings in that key, fewer words are required to point out the error. But from a careful compariſon of theſe regulated Scales, with compoſitions in all the different keys, and in the works of all the compoſers I have hitherto had occaſion to examine, ſimilar errors are very frequently to be found: and therefore, ſuppoſing ſuch compoſitions to be executed with the utmoſt accuracy upon the violin, they muſt notwithſtanding be out of tune by comma. This will ſtill more clearly appear in Part II.

But when it is conſidered how improbable it muſt be that any performer ever was able to execute, even to the degree of exactneſs meant in ſuch compoſitions, it may be believed, that the errors of the very beſt violin-performers are ſtill greater than thoſe found in inſtruments with fixed notes of the preſent conſtruction.

Since thus it appears probable, that true tune has never yet been heard in performance, the acquiſition of a ſeries of fixed notes, capable of producing it, muſt be very deſirable; eſpecially if it be conſidered, that there are almoſt innumerable degrees in approaching to it, perceptible by the ear; as the experiment mentioned pages 133, 134, 135, or even a trial with the bare finger, will ſhew: for the interval of comma requires a very conſiderable alteration of the place of the finger upon the violin; and it will be found, that after an approach has been made towards true tune as near as may be, by an actual removal of the finger, ſtill the effects of a ſmall roll, or even a different degree of preſſure, will become ſenſible to the ear. So delicate a matter it is to touch the inſtrument truely, and ſo little foundation has there been for the pretenſions to merit on this point.

Our being pleaſed at all in ſuch circumſtances is probably owing to a ſecret effort of the mind, exerting itſelf to ſupply the defect, in an approach to what is really beautiful; and the nearer the approach, the leſs force being upon the imagination, the pleaſure becomes proportionably greater. But the explanation of this matter belongs more properly to philoſophy than to a treatiſe of this kind; only this obſervation ſeems neceſſary at preſent, in order to account, in ſome meaſure,

ſure, not only why we are pleaſed, but why we are not greatly offended.

Independent of the truth of theory, upon the principles of which theſe ſcales are formed, their importance will clearly appear from the following conſiderations.

A performer upon the fiddle, having no limited pitch from which he is neceſſarily obliged to derive his tune, but only in general from the tune of the open ſtrings, he may take the open ſecond ſtring as ſixth, and the open firſt ſtring as third, to the natural key major C: and it is neither more difficult nor unnatural to derive the other degrees of tune belonging to this key juſtly from theſe, than from the other open ſtrings pointed out in the regulated ſcales. But ſhould he form his hand in this manner, and afterwards join in concert with one who has practiſed according to the pitch in the ſcales; if each of them perform accurately in tune to his own pitch, they muſt conſtantly be out of tune to each other. For it will not ſurely be denied, that it is owing to a habit acquired from practice, that a performer is enabled readily to ſtrike what is commonly admitted as good tune; and if the habits of one performer diſagree with thoſe of another, admitting that each ſeparately be able to perform in good tune, yet together they muſt jar: Againſt which diſadvantage there can be no other ſecurity than one common rule; and it is preſumed that theſe ſcales, ſo far as they have been carried, will be found unexceptionable guides to true practice.

But it cannot be ſuppoſed that the ſteadieſt performer ever adhered ſo invariably to any particular mode of ſtriking tune, as to riſk an uniform diſagreement with another in the manner before mentioned. The tune of the open ſtrings probably leads and miſleads univerſally, as opportunity ſerves beſt for touching or referring to them: And in concert, the whole being bound to a kind of medium by the imperfect tune of the harpſichord, the errors may rather be ſaid to be negatively than poſitively felt; although they certainly exiſt in full extent, while ſome performers are following the tune of one ſtring, and others that of a different one.

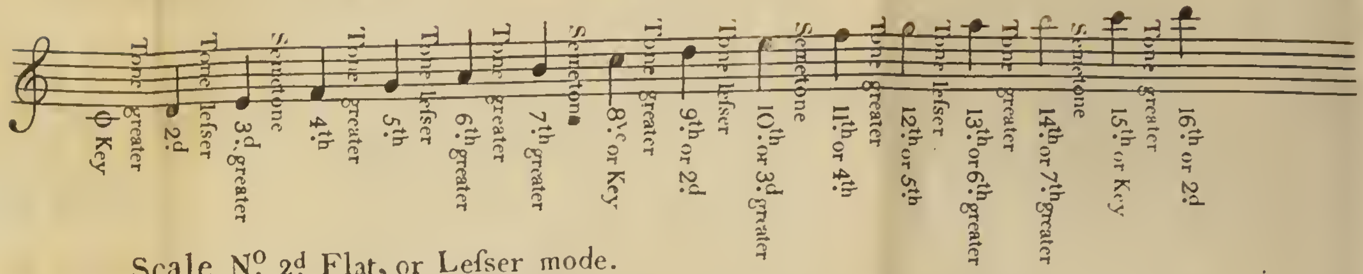
This may be illuſtrated from a ſolo performed on the violin, where the chords are ſtruck very agreeably; yet it is preſumed, that if the beſt performer ſtop ſhort and make deliberate trial, he will be able to improve his tune very ſenſibly, almoſt in every note. This muſt ſhew, that although the defect did not amount to direct offence, nay that the degree of approach was highly pleaſing; yet if imperfection had not marred it, the effect of the performance would have been greatly heightened. It muſt likewiſe ſhew, that ſuch errors, although they leave us in poſſeſſion of high muſical entertainment, yet unqueſtionably they deaden and load it; giving reaſon to believe, that if they could be removed, our muſical performances would be greatly improved.

The effect of this refined regulation of tune might be left to be judged of from experience, upon fair trial. But few great performers will be found willing to acknowledge ſuch defects in their practice as theſe ſcales infallibly diſcover; and, without bringing reaſon to our aid, the authority of great names might prevail upon others leſs acquainted with the ſubject to treat them with neglect. Therefore, to what has been already ſaid, it may ſtill be neceſſary to add, that a performer, who pretends to approach to perfect tune without the aſſiſtance of ſuch a guide, is ſurely not aware of the difficulty of his undertaking; for it will ſoon be ſhewn, that it is no leſs than to affirm, that his hand is able to diſtinguiſh not leſs than forty-four different degrees of tune within the limits of octave. No doubt the ear can do this; but can we believe that the hand can approach to it in practice? Beſides what has been demonſtrated to be the practice of the greateſt maſters, it will ſoon appear, that many of theſe diſtinctions are ſo extremely minute as the ratio $\frac{32805}{32768}$; and many degrees of tune, which are repreſented in the common mode of writing muſic by notes which mark no diſtinction of their pitch, are really different by no leſs than double comma, which is nearly equal to a fourth part of the greater tone: ſituated, too, under the great diſadvantages of a very remote relation to the tune of any of the open ſtrings, and very often directly under the influence of ſome one of them, whoſe tune being falſe, muſt certainly miſlead.

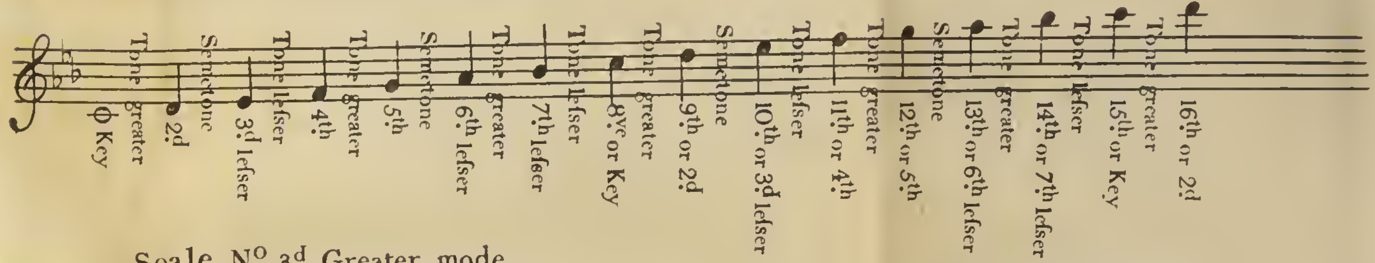
The firſt ſtep towards amendment is the conviction of error. This is the merit to which the preceding part of this Eſſay lays claim. Perhaps it might be added, that it in ſome meaſure points out the way to amendment. But beſides the practical difficulty of ſtopping the fiddle accurately, as theſe ſcales direct, much ſtill remains to be diſcovered of the principles of tune itſelf, and of the nature of the ſcale of muſic. This ſubject is reſerved for a ſecond part; in which it is propoſed, firſt, to lay down a plan for the tune of the organ, after a method ſimilar to that which has been followed in the inveſtigation of the tune of the fiddle: and, ſecondly, to examine the relations of the ſeveral degrees of tune ariſing from it. This will lead to a ſolution of ſome problems concerning the ſcale of muſic which have baffled the learned in all ages, and to a diſcovery of ſome properties of tune which have hitherto lurked in concealment.

Plate I.

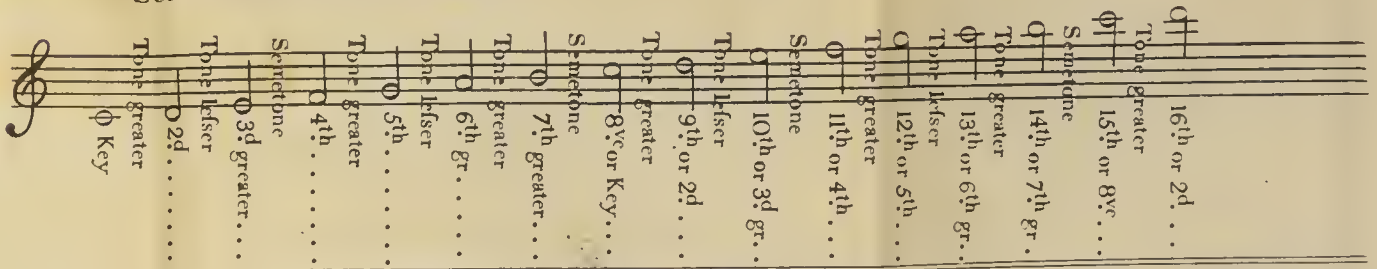
Scale No. 1st Sharp or Greater mode.



Scale No. 2d Flat, or Leſser mode.

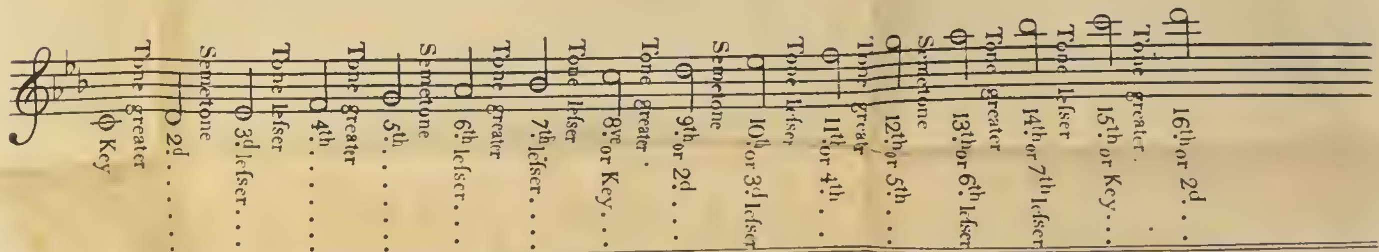


Scale No. 3d Greater mode.



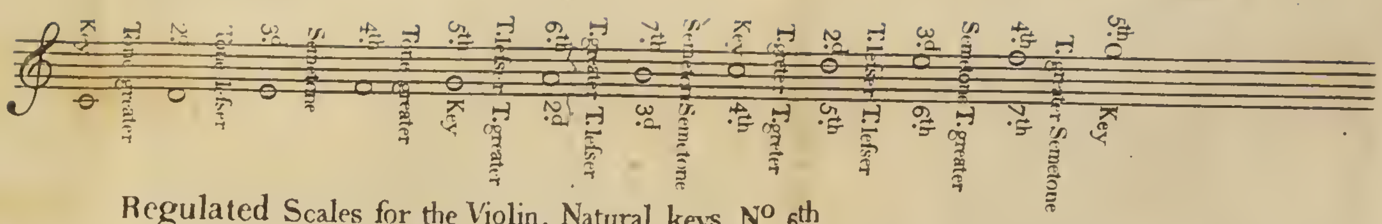
Tones Greater	1	1	1	2	2	3	3	4	4	4	5	5	6	6	7
Tones Leſser		1	1	1	2	2	2	2	3	3	3	4	4	4	4
Semitones			1	1	1	1	2	2	2	3	3	3	3	4	4

Scale No. 4th Leſser mode.

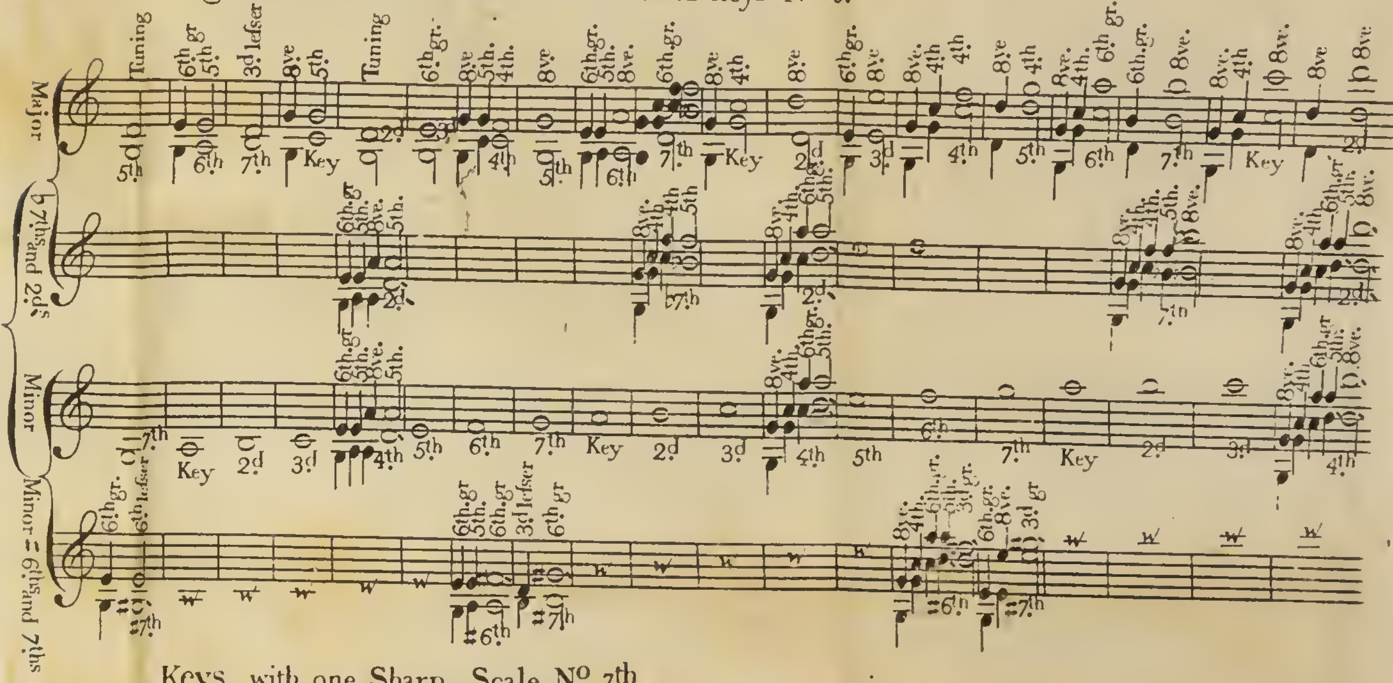


Tones Greater	1	1	1	2	2	3	3	4	4	4	5	5	6	6	7
Tones Leſser			1	1	1	1	2	2	2	3	3	3	3	4	4
Semetones		1	1	1	2	2	2	2	3	3	3	4	4	4	4

Scale Nº 5th



Regulated Scales for the Violin. Natural keys Nº 6th



Keys with one Sharp. Scale Nº 7th

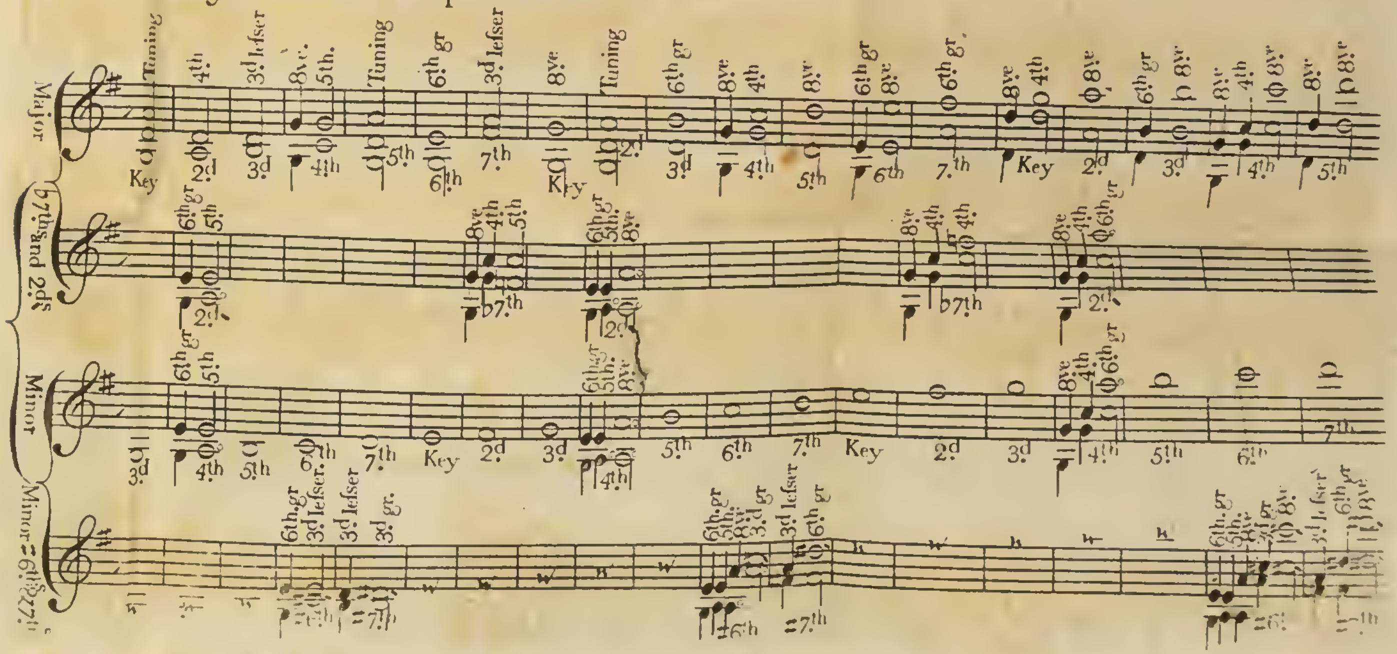
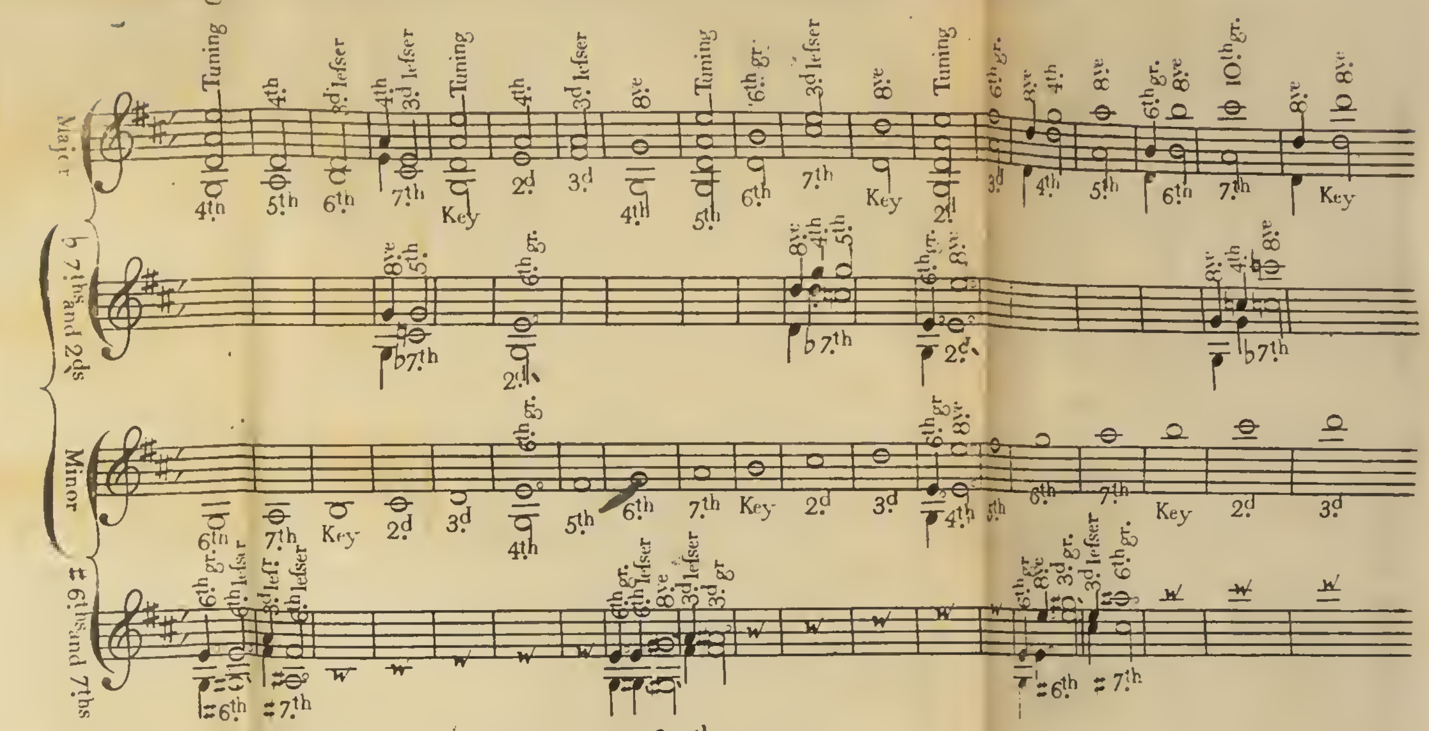
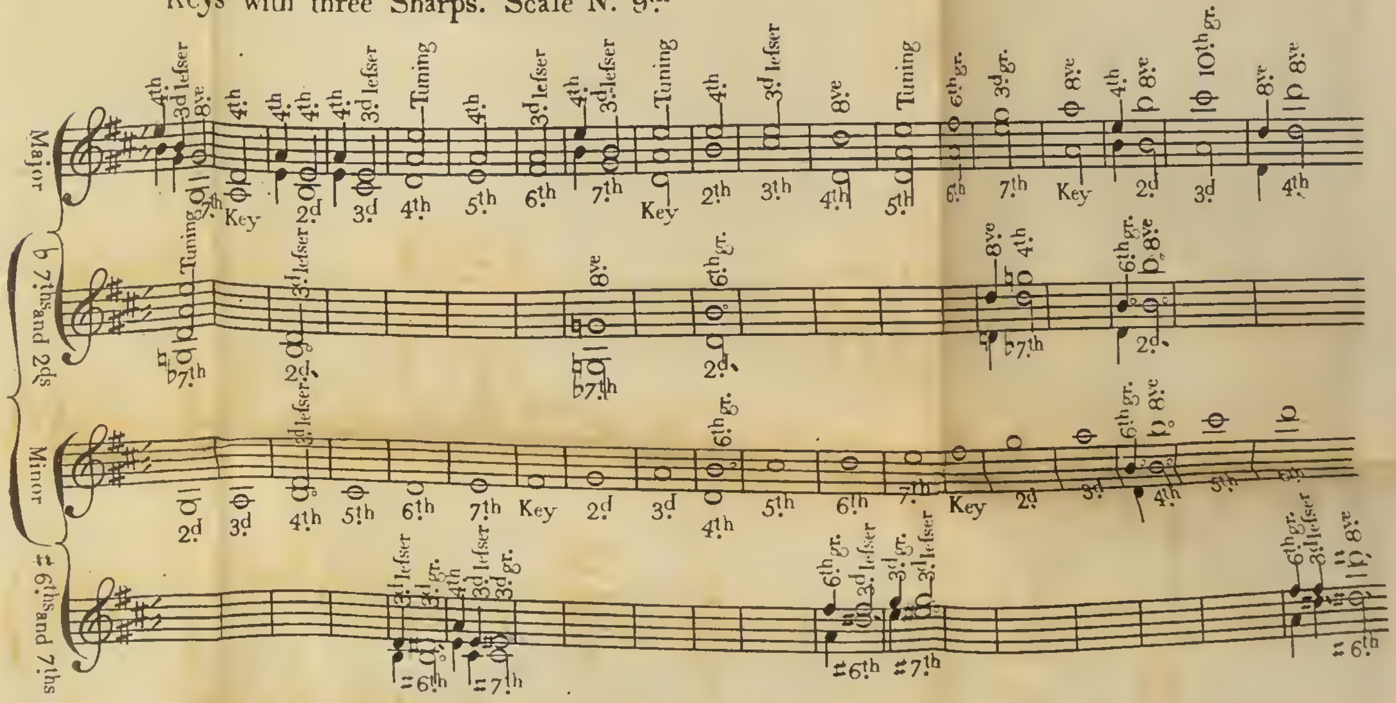


Plate III.

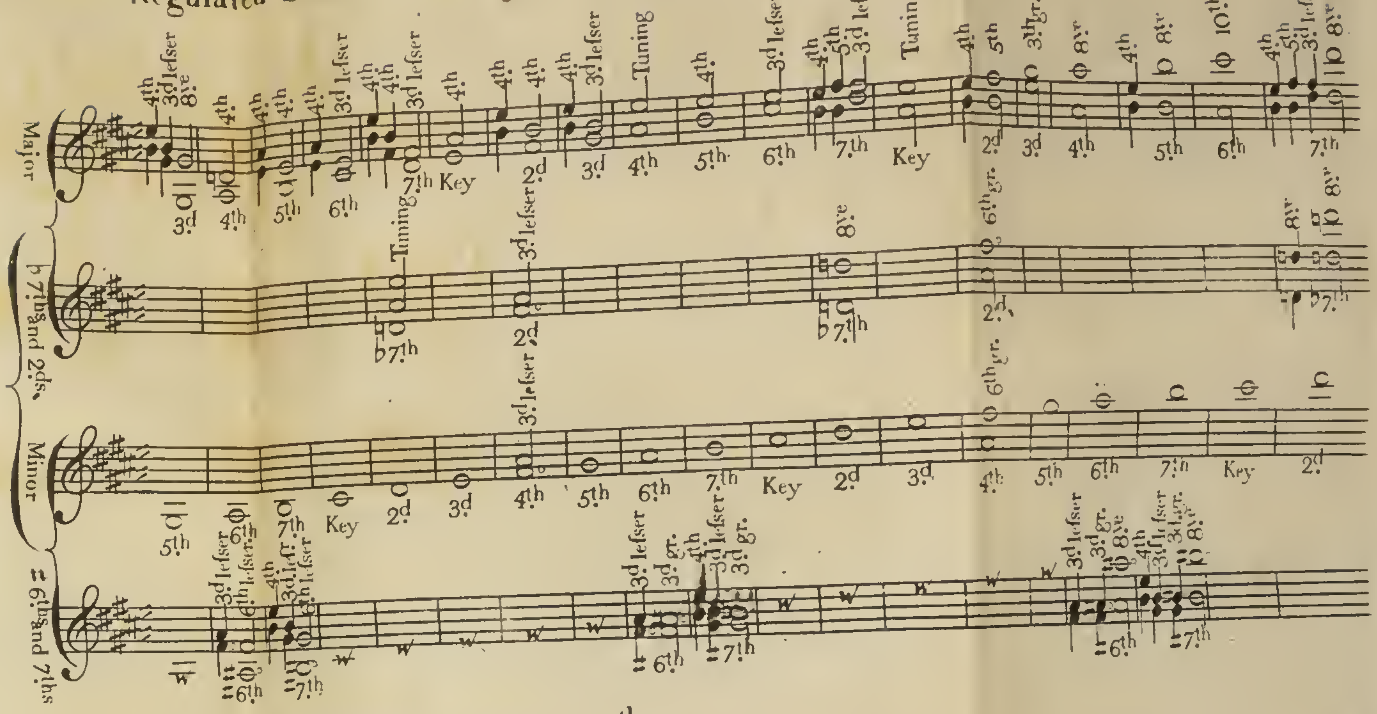
Regulated Scales for the Violin. Keys with two Sharps. Scale No. 8th



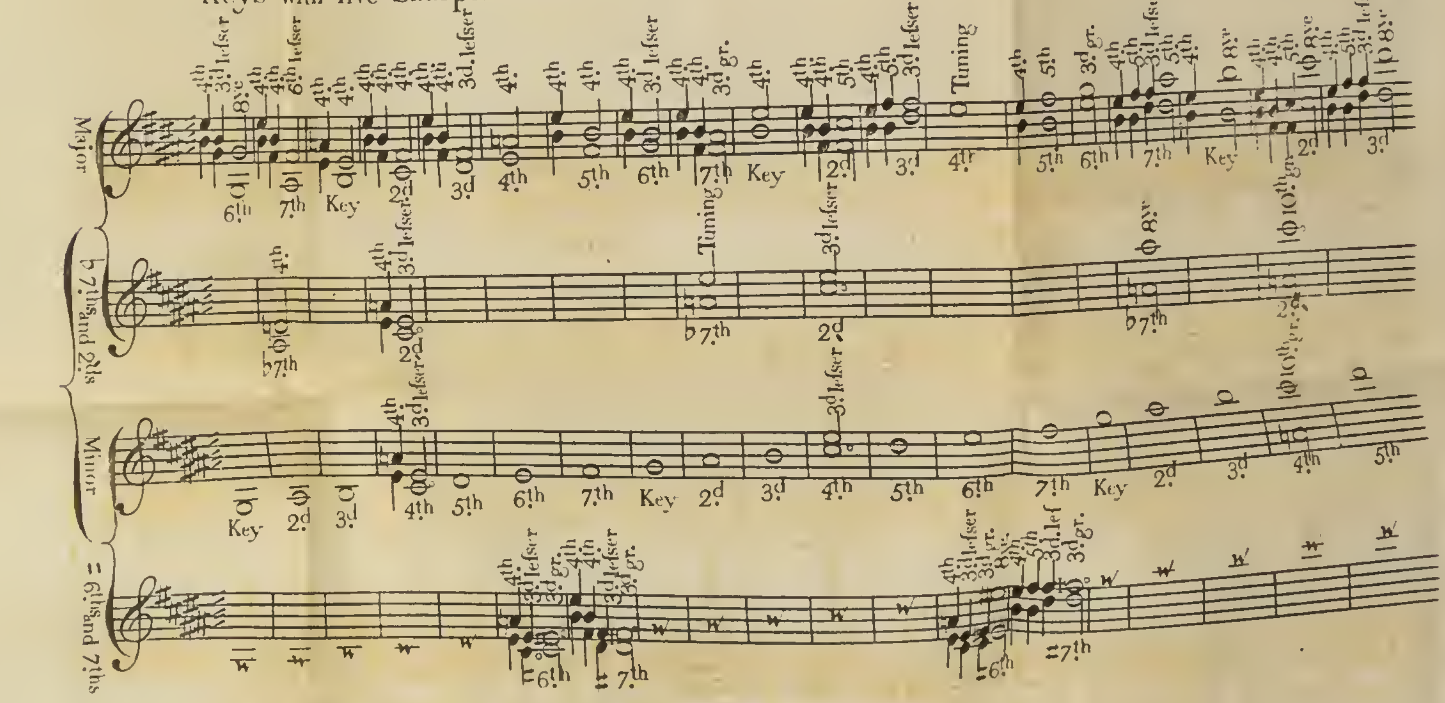
Keys with three Sharps. Scale No. 9th



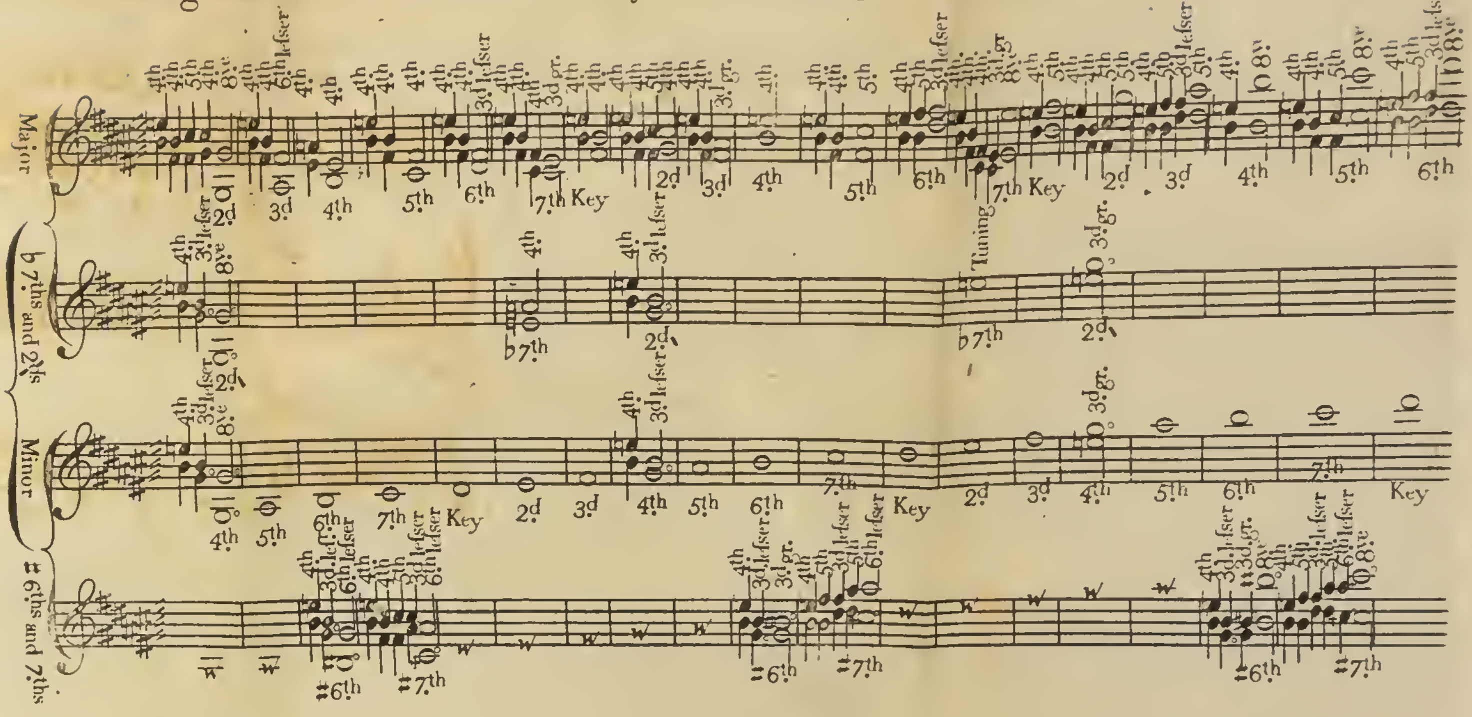
Regulated Scales for the Violin. Keys with four Sharps. Scale No. 10th



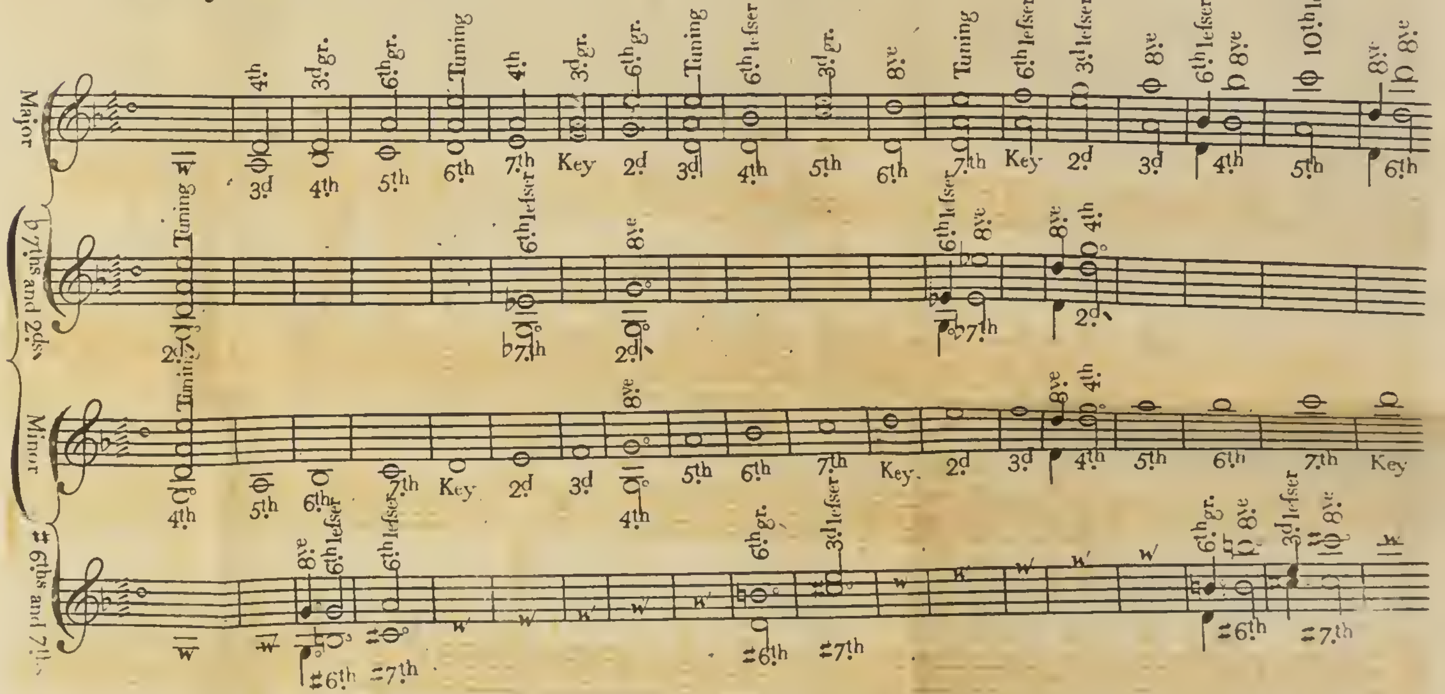
Keys with five Sharps. Scale No. 11th



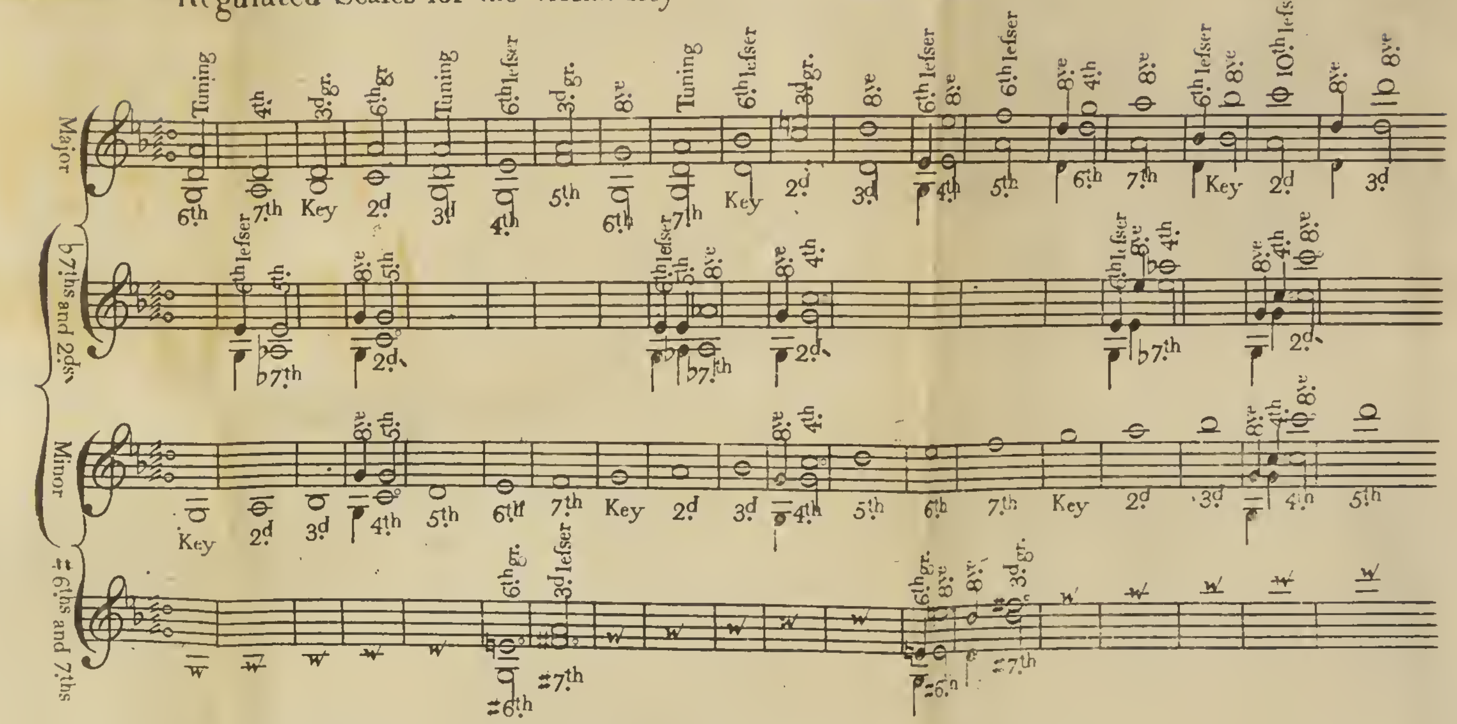
Regulated Scales for the Violin. Keys with ſix Sharps. Scale N.º 12th



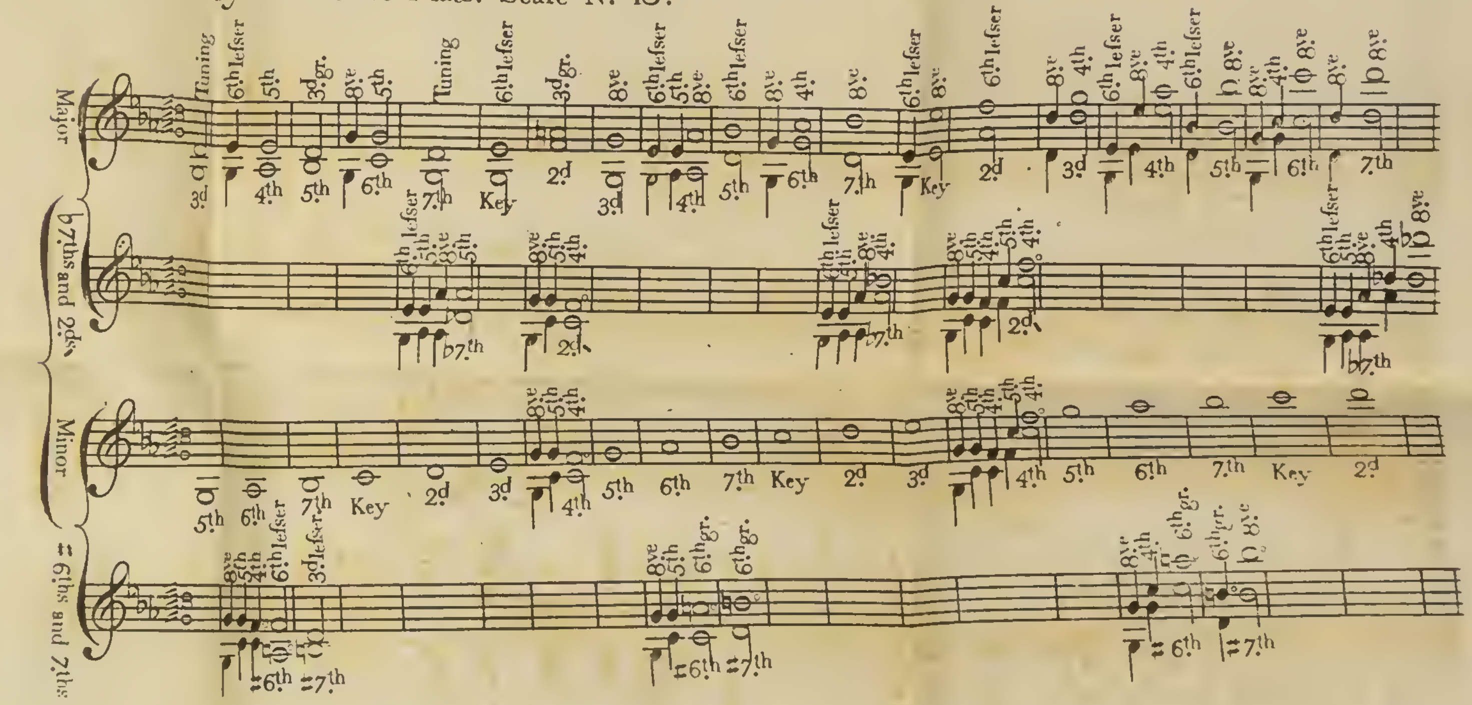
Keys with one Flat. Scale N.º 13th



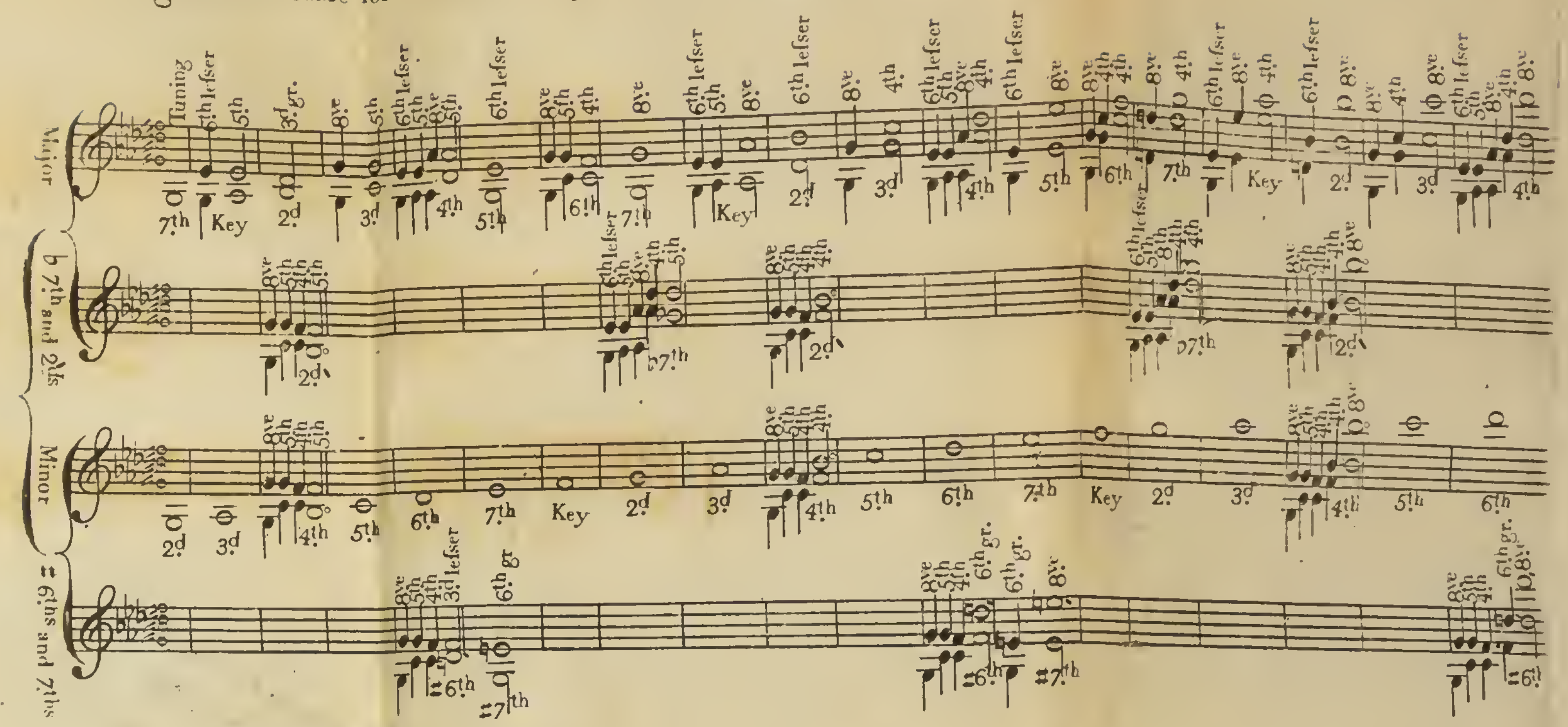
Regulated Scales for the Violin. Keys with two Flats. Scale Nº 14th



Keys with three Flats. Scale Nº 15th



Regulated Scale for the Violin. Keys with four Flats. Scale No. 16th



Keys with five Flats. Scale No. 17.

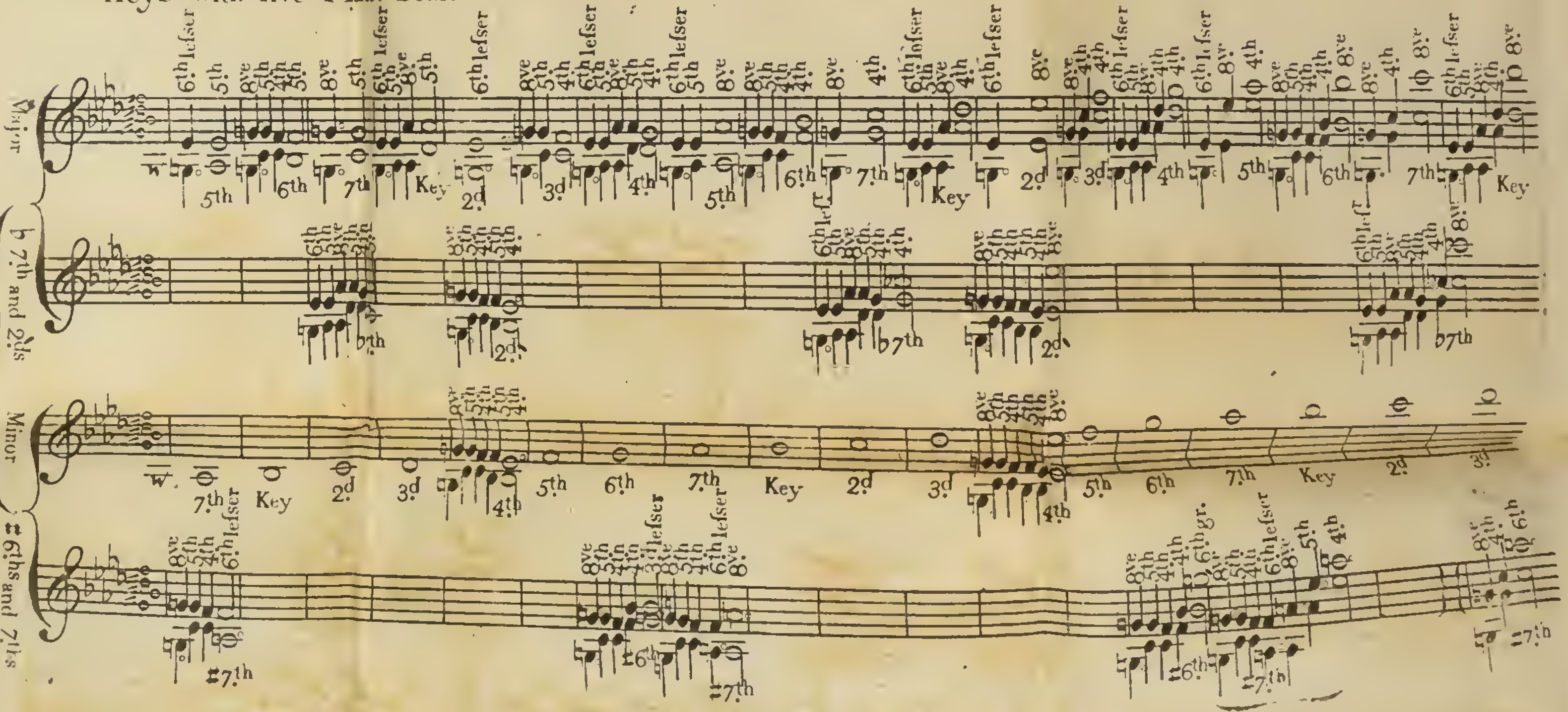


Plate VIII.

Fig. XVIII.

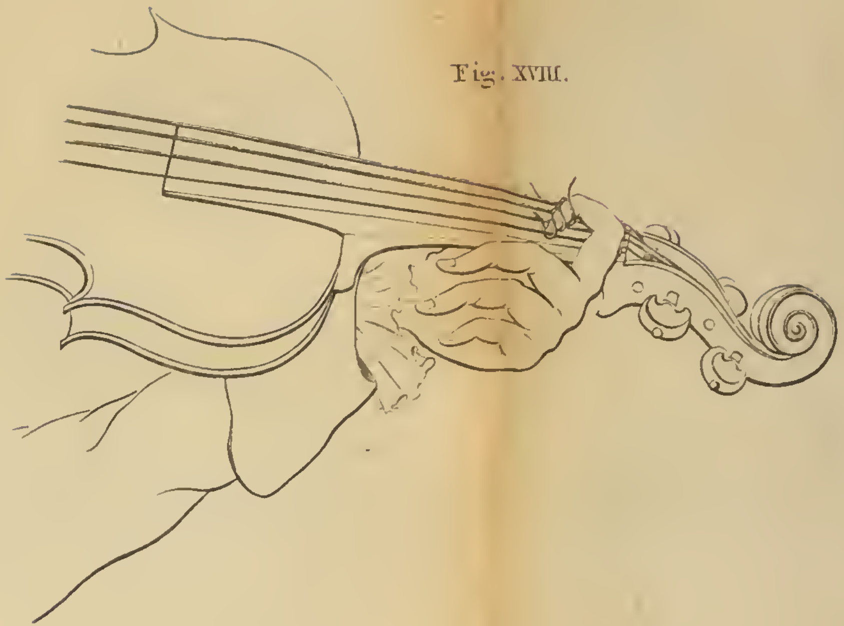
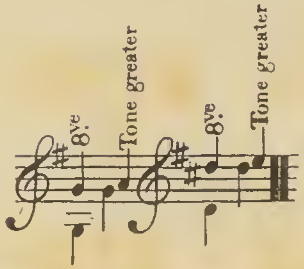


Fig 19



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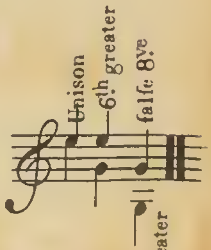

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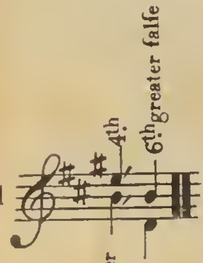

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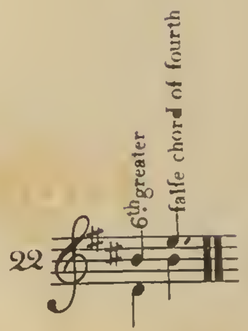

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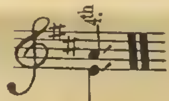

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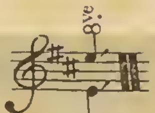

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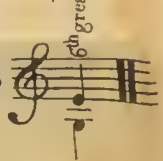

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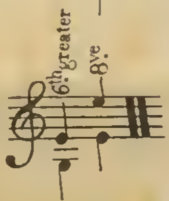

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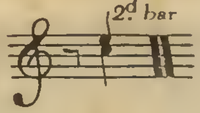

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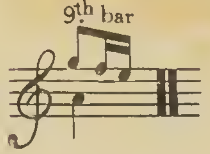

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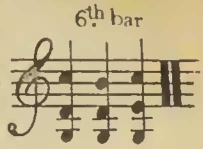

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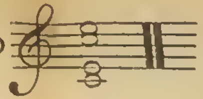

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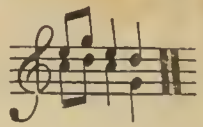


XVIII.

PART II.

Of the TUNE of the ORGAN.

CHAP. I.

Explanation of the Scales N° 32. to N° 43.

THE tune of ſuch an inſtrument as the organ falls next under examination.

Altho' ſuch an inſtrument may yield to the violin in ſome of the powers of expreſſion; yet the organ, beſides its advantages in other reſpects, will be found capable of being freed from the two great defects to which the ordinary fiddle, unreformed, muſt ſtill be liable. In the firſt place, it can be freed from the irregularity in the connection of the keys mentioned in the Firſt Part: becauſe, being under no neceſſity to attend to the tune of four fixed notes, (the open ſtrings), which govern the whole tune of the fiddle; in tuning the organ, we have it in our power, after deriving a variety of notes from one fixed tone aſſumed as the ground of the whole, to fix all theſe ſeveral notes, and derive others from them. Secondly, it is not liable to the uncertainty of finding the true tune of any note in performance: becauſe, in tuning the organ, every degree of tune, being deliberately adjuſted, and ſubjected to a great variety of check-examinations, may be fixed, and ſtand ready for the performer.

It ſeems to be a matter of perfect indifference, in tuning the organ, with what key we begin. Perhaps it would be more uniform to prefer the keys with five flats; and from theſe to proceed regularly, by taking each ſucceeding key-note chord of fifth above the former key-note through the whole twelve ſignatures. In this caſe, a flat, and alſo a grave mark, muſt be taken off from each ſucceeding ſignature in the progreſs towards the natural keys; and a ſharp, and alſo an acute mark, muſt be added to each ſucceeding ſignature during the progreſs forward from the natural keys to the ſignature with ſix ſharps.

But to follow the common method, of making the other keys ariſe from the natural ſcale, it ſeems better to take the departure from it, and to proceed as before, making the fifth of each preceding key major, key-note to the ſucceeding key major, and adding one ſharp and one acute mark to each ſucceeding ſignature, till we arrive at the ſignature with ſix ſharps; and from this ſignature returning to the natural ſcale, again proceed in the order, according to the rules given for forming the keys with flats, till the twelve ſignatures, containing in all twenty-four keys, be completed in the ſignature with five flats.

In order to trace the connection of tune with greater eaſe, it may be requiſite to have a table of affinities, ſhewing the concordant relations in which each note ſtands to others in the diatonick ſcale for both modes. This is nothing more than ſetting down in a table, which may be eaſily traced by the eye, the ſeveral intervals from each note to another with which it ſtands in true concordant relation, neglecting all ſuch intervals as are held to be falſe or diſcordant; becauſe the ſyſtem of tune muſt only be conſtructed by reference to the acknowledged concords, the ear not being ſuppoſed to be an adequate judge of the true pitch of diſcord: Although to this opinion I would not be underſtood to have ſubſcribed.

TABLES OF AFFINITIES.

TABLE for the MAJOR MODE.

	is chord of	to the	of the key, or chord of	
Key-note	3d greater 4th 5th 6th gr. octave	3d greater 4th 5th 6th gr. octave	6th leſſer 5th 4th 3d leſſer octave	to its 8ve below
Second of the key	4th 6th gr.	5th 7th	5th 3d leſſer	
Third of the key	3d greater 3d leſſer 4th 5th	Key-note 5th 6th 7th	6th leſſer 6th gr. 5th 4th	to its 8ve above to its 8ve below
Fourth of the key	4th 3d greater	Key-note 6th	5th 6th leſſer	to its 8ve above to its 8ve below
Fifth of the key	5th 3d leſſer 4th 3d greater	Key-note 3d 2d 7th	4th 6th gr. 5th 6th leſſer	to its 8ve above to its 8ve below
Sixth of the key	6th gr. 4th 3d greater	Key-note 3d 4th	3d leſſer 5th 6th leſſer	to its 8ve above
Seventh of the key	6th gr. 5th 3d greater	2d 3d 5th	3d leſſer 4th ~~leſſer~~ 6th leſſer	

TABLE for the MINOR MODE.

	muſt become chord of	to the	and muſt be chord of	
Fourth of the key	3d greater 3d leſſer 4th	6th gr. 6th leſſer Key-note	6th leſſer 6th gr. 5th	to its 8ve below to its 8ve above
Sixth leſſer	6th leſſer 3d leſſer	Key-note 4th	3d greater 6th gr.	
Sixth greater	6th gr. 3d greater	Key-note 4th	3d leſſer 6th leſſer	
Seventh leſſer	3d leſſer 6th leſſer	5th 2d	6th gr. 3d greater	
Seventh greater	6th gr. 3d greater	2d 5th	3d leſſer 6th leſſer	

Theſe tables are not meant to be univerſal, but only to comprehend ſuch concordant relations as there may be occaſion to uſe in regulating the tune of the organ; the firſt containing what is required for tuning the major mode, and the ſecond ſuch additions as are wanting for tuning the minor mode.

In the Firſt Part of this Eſſay, the reader was referred to the Scales N° 3. and 4. for the ſake of fixing an idea of the ſituation and true quantities of the concordant intervals. After this, the Table of Affinities may be uſed, having theſe intervals ready ſummed up, to ſave the trouble of counting the degrees upon the ſcales, which ſtill may be done in the caſe of doubt.

In theſe tables, the double relation of each note is marked; that is, not only the relation of any note to any degree of the ſcale below it, but alſo to the ſame degree above it. For example: In the key natural C, if G be compared with the key-note below, the relation is chord of fifth; but if the ſame G be compared with the key-note above, the relation is chord of fourth. Hence the complement of the chord of fifth to octave is chord of fourth; and the complement of every chord to octave is alſo concord. Thus the chord of ſixth greater, added to the chord of third leſſer, make octave. The reſt appear in the Table of Affinities: but a further account of this matter belongs properly to the more abſtract theory; this much ſeems neceſſary for explaining the terms.

It muſt be obſerved, that, in conſtructing the ſcales for the organ, the ſingle relations of the chords to each particular note are only marked, without adding the complements, except on the ſeconds and fourths of the keys; the concordant relations of theſe laſt being ſo few, that the complements may be admitted without crowding. Upon all the other notes, whoſe concordant relations are more numerous, the complements of the chords are left to be found by taking octaves.

In the tables, the ſecond and fourth of

any key have not been admitted to ſtand as chord of third to each other; although very frequently they are found to ſtand together in compoſition in that relation. But unleſs either the ſecond be flattened, or the fourth raiſed, or both altered, they cannot yield chord of third; becauſe that interval, as it preſently ſtands in the diatonick ſcale, is comma leſs than the chord of third. But of this more particularly afterwards; and in the mean time it is proper to proceed to give a ſpecimen of the method of examining the ſcales for the tune of the organ.

In theſe ſcales, the marks in the ſignatures of the keys with flats are different from thoſe for the fiddle; but this difference, as has been ſaid, is owing to an irregularity admitted into the tune of the fiddle, which there is no occaſion to adopt in that of the organ. See Scales N° 32. to N° 43.

Perhaps any further explanation of theſe ſcales may be thought ſuperfluous; but to leave any obſcurity or defect in treating ſo difficult a ſubject ſeems unwarrantable.

In all the keys major, the tune of each key from the key-note is plainly the ſame as marked in the Table of Affinities; which being derived from the diatonick ſcale, may be compared with it in Scales N° 3. and 4.: therefore each of theſe keys major muſt of itſelf be in true diatonick tune; and the connection with one another is alſo perfect. For, beginning with the key major with five flats, and proceeding from that key through the other keys with flats towards the natural key, and from this by the keys with one ſharp, in order, to the keys with ſix ſharps; the key-note of each ſucceeding key will be found to be pitched true chord of fifth to the key-note of the preceding key. All the notes of the preceding key are alſo true notes of the ſucceeding one; except the fourth of the preceding key, which will be found to be raiſed to the true pitch for the ſeventh of the ſucceeding one; a flat mark being removed, or a ſharp mark added. And the ſixth of the preceding key will alſo be found to be raiſed comma, ſo as to become a true ſecond to the ſucceeding key; a grave mark being removed, or an acute mark added. And this is ſtrictly obſerved through the whole, according to Rule I. (page 48.) For this rule, as has already been obſerved, holds through the whole when this order of progreſs through the keys major is followed; and it is only the major mode that is now ſpoken of. The ſecond rule will alſo hold through the whole in the order beginning with ſix ſharps, and ending with five flats: therefore all the keys major are in true tune, and perfectly connected. And it ſhall ſtill more particularly be ſhewn how this is effected, in comparing the natural key major C with the key major G with one ſharp.

C being the key-note of the natural key major, its ſixth, A, is tuned chord of ſixth greater above; which, by the Scale N° 3. is compoſed of two tones greater, two tones leſſer, and one ſemi-tone: and G of the ſame key being tuned chord of fifth above the key-note C, the interval between C and G contains two tones greater, one tone leſſer, and one ſemi-tone; which laſt ſum being ſubtracted from the former, leaves the tone leſſer as the difference between G and A. But when G becomes the key-note of the key major with one ſharp, the interval between the key-note and its ſecond muſt be tone greater: therefore one of theſe two, G or A, muſt be removed to its due diſtance from the other. But it would break the connection between the keys if the key-notes were made to diſagree: therefore G muſt remain in its pitch, and A alone be altered.

This is effected by tuning A′ chord of fifth above D. D being tone greater above C, the interval from C to this new A′ is tone greater added to chord of fifth, which is equal to three tones greater, one tone leſſer, and one ſemi-tone. But A, as it ſtood before tuned chord of ſixth greater to C, made an interval of two tones greater, two tones leſſer, and one ſemi-tone; which laſt ſum is leſs than the former by the difference between the tone greater and the tone leſſer: therefore this new A′, tuned chord of fifth above D, is comma ſharper than A, which was ſixth to the key C; conſequently it is a true ſecond to the key major G with one ſharp.

Again, F, the fourth of the natural key major C, is tone greater below G, the fifth of the ſame key. But when G becomes the key-note of the major mode with one ſharp, it muſt have its ſeventh ſtanding ſemi-tone below, in the ſame relation to it as did the ſeventh of the former key. There muſt therefore be a new note tuned for this purpoſe; and although it is named by the ſame letter F, it muſt have a ſharp mark affixed to it, denoting that it is removed higher by the diſtance of limma major.

This ※F muſt be tuned chord of ſixth greater above A′: becauſe, by the Table of Affinities, the ſeventh of the key major is chord of ſixth greater above its ſecond.

cond. But, by the ſame Table, it may be tuned chord of fifth above the third of the key, which is B; or chord of third greater above the fifth, which is D; as appears marked on the Scale N° 33.

It ſeems worthy of obſervation, that theſe two notes which are ſecond and ſeventh of the new key, are both diſcords to the key-note; but they are tuned as concords to other notes, which are of a pitch common to both keys. From which defect in their relation to their proper key-note, and connection with the tune of the former key, they ſeem to bear a very characteriſtic medium relation to both: and as all the other notes are common to both keys, they may be ſaid in ſome ſenſe to fortify the connection; eſpecially when it is probable, from what ſhall be ſaid afterwards, that the ſecond and ſeventh of every key major muſt become changeable, and ſometimes take the pitch theſe notes held in the preceding key, in the order from flats to ſharps.

This may ſuffice for ſhewing the connection of all the keys major with one another in their order. For it is perfectly uniform through the whole, and may now be eaſily examined; always, however, taking particular care to take into the conſideration of their relations the effects of the pitch of tune which the grave and acute marks indicate, as well as the ſharp and flat.

The relation and dependence of the minor upon the major mode of the ſame ſignature having been fully explained in the Firſt Part, it would be altogether ſuperfluous to add more here. It need only be recollected, that the pitch of the notes is the ſame in both modes; excepting only the fourth of the minor, which is comma flatter than the ſecond of the major; and alſo the ſixth and ſeventh greater, which are occaſionally uſed in the key minor. In the ſcales, therefore, for the tune of the organ, all the pitches of tune required for the minor mode being prepared in the tune of the major, excepting theſe three, the notes are ſimply put down by themſelves in the ſtaff of the minor mode, referring to the regulation of the note of the major directly over each for ſhewing their pitch. The other three notes, whoſe tune is different from all the notes of the key major over them, have their own particular regulation marked in the ſtaff appropriated to the key minor.

The tune of the ſixth and ſeventh leſſer of the minor is ſhewn in theſe diviſions of the major mode directly over the places where that of the ſixth and ſeventh greater of the minor is marked: for it ſeemed needleſs to make a third ſtaff for the tune of the organ, ſince inquiry is here only made into the tune of the inſtrument, without view to direct the practice, which it ſeemed proper to have an eye to in regulating the tune of the fiddle.

One ſpecimen ſhall likewiſe be given of the formation of theſe three notes, which muſt render the examination of all the reſt perfectly eaſy.

G, the fifth of the natural key major, is tuned chord of fifth above C the key-note; and D, the ſecond, is again tuned from the ſame G chord of fourth below it: for when the chord of fourth is ſubtracted from the chord of fifth, the remaining interval is tone greater: therefore D, thus tuned, is a true ſecond to the key C, being tone greater above it. But A is tuned chord of ſixth greater above C; and if Dˋ be tuned chord of fifth downwards from A, this laſt Dˋ ſhall be comma flatter than D: for the chord of fifth being ſubtracted from the chord of ſixth greater, the remaining interval between C and Dˋ is tone leſſer. But the complement of the chord of fifth to octave is chord of fourth: therefore if another Dˋˋ be tuned chord of fourth above A, it ſhall be octave to Dˋ tuned downwards from the ſame A as before; and conſequently Dˋ, ſo tuned, is the true fourth of the key minor A natural.

The fourth of the key minor with one ſharp, has the negative mark, to ſhew that it is comma flatter than A′, the ſecond of the key major G with one ſharp, and that it is of the ſame pitch with A, the ſixth of the key major C; and ſo of the reſt: therefore this A° need not be tuned anew; and referring to the tune of A in the natural key major C, the note is only marked in its place, without any regulation upon it. And the tune of the fourth of each ſucceeding key minor is always referred to that of the ſixth of the major of the preceding ſignature, in proceeding towards the ſignature of ſix ſharps.

But, in proceeding by the order from the natural ſignature towards the ſignature with five flats, the operations being reverſed, the pitch of the fourth of each key minor does not ariſe in the major mode till the ſixth of the ſucceeding key major appear: therefore it ſeems beſt to expreſs its proper regulation upon the note, there being nothing already prepared to refer to. The regulation of the ſame degree of tune is repeated in the ſucceeding key major; becauſe it may be beſt to keep the regulation of the keys major always full, having all along reaſoned from the major to the minor mode; which laſt has only been conſidered as dependent upon the former.

The regulation of the ſixth greater is exceedingly obvious. A, the ſixth of the natural key major, being the key-note of the minor mode of the ſame ſignature, tune ※Fˋ chord of ſixth greater above it, and it is the ſharp ſixth of the key; but a grave mark is put upon it, for the reaſon given in pages 68, 69.

It need only be noticed here, that this ※Fˋ is alſo tuned chord of third greater above Dˋ; while ※F, the ſeventh of the key major G with one ſharp, which is truly limma major acuter than F, is tuned chord of third greater above D, and therefore muſt be comma acuter.

The ſeventh greater of every key is chord of third greater above its fifth. The third of the key major is always the fifth of the key minor of the ſame ſignature: therefore ※Gˋ, the ſeventh greater of the key minor A, is tuned chord of third greater above E, the fifth of the ſame key. This ſeventh greater, too, has a grave mark, for the reaſon already given. It is tuned chord of third greater above E, while *G is tuned chord of third greater above E′.

It may alſo be noticed, that the key-note of the key minor A natural having no acute mark, and the key-note of the key major A′ with three ſharps having the acute mark, the ſixth and ſeventh greater of the former muſt be comma flatter than the ſixth and ſeventh greater of the latter.

In theſe accounts of the regulation of tune, there has only been noticed one particular chord as regulating the note ſpoken of at the time, although ſeveral more are marked in the ſcales. This is done to avoid embarraſſing the ſubject with too many words. The whole ſeems ſo exceedingly obvious, that we are rather apprehenſive of having exceeded the due bounds of explanation.

CHAP. II.

Explanation of the ſcale for tuning the organ; and the number of the degrees of tune required in each octave.

TO ſhew the ſyſtem of tune contained in the Scales N° 32. to N° 43. in different lights, and to ſubject it to examination in various ways; likewiſe to furniſh a method for tuning the organ by chords of fifth chiefly, the chords generally uſed in tuning ſuch inſtruments; a Scale, N°44. is drawn, called the *tuning-ſcale*.

In this tuning-ſcale, every pitch comprehended in the former ſcales is inſerted, and to each of theſe the concords which connect it with the pitch-note are marked in a different way. But, in tuning the inſtrument conſtructed according to the propoſed plan, there is this material difference to be obſerved from the method uſed in tuning the common organ, that all the chords of fifth, and alſo every other chord in the inſtrument, muſt be made truly perfect; whereas the nature of the preſent defective inſtruments cannot admit any interval to be made perfectly accurate, but all of them muſt be tempered, or, in other words, put a little out of tune.

In each diviſion of the tuning-ſcale, diſtinguiſhed by a double-bar mark, after the crotchets which lead to the tune of the firſt minim from the pitch-note, the ſucceeding intervals are all chords of fifth, as marked by the figures over the notes to the end of the double bar.

To explain the nature of this tuning-ſcale, let it be underſtood, that C being pitched, the interval between it and D the ſecond muſt be tone greater; and how this tone greater is found by firſt tuning G chord of fifth above C, and from that fifth, taking a chord of fourth, downwards to D, has been ſhewn already, page 168. The tune of E, F, G, and A, ſtand directly as chords of third greater, fourth, fifth, and ſixth greater, reſpectively, as marked over them, to the pitch-note

C. And the ſeventh greater of any key, being chord of fifth above the third greater of the ſame, B, tuned as in the ſcale, is the ſeventh of the key major natural. If it be conſidered, that, in the progreſs through the keys major with ſharps in order, the fifth of each preceding key was aſſumed as key-note to the ſucceeding key, it is plain, that all the other notes of each ſucceeding key muſt be made chord of fifth to the correſponding notes of the preceding one. Thus, *F, the ſeventh of the key major G with one ſharp, is chord of fifth to B, the ſeventh of the key major natural C; and proceeding to make *C chord of fifth to *F, and ſo forth to *E′, the ſeventh of the key major F′ with ſix ſharps, all the ſevenths of the keys major with ſharps ſhall be in true tune for their reſpective keys; originating from the pitch-note at the beginning, and ending with *E′, the laſt note of the firſt diviſion of the tuning-ſcale.

In this tuning of the ſevenths in ſharps, and alſo through all the following diviſions of the tuning-ſcale, very often the chord of octave is introduced; but this alters not the relation of the chords of fifth, but only reduces the marking of the tune to the bounds of the ſtaff, which otherwiſe would fly off above, or ſink too much below it.

Farther, F, the fourth of the key major C, for the reaſons already given, being the key-note of the key major with one flat, ♭B is the fourth of that key. In tuning the keys major with flats, in their order from the natural key major, the method of proceeding being reverſed, the correſponding notes of each ſucceeding key muſt become chord of fifth to thoſe of the preceding one, counting downwards. Thus ♭B, being the fourth of the key major F with one flat, ♭E, the fourth of the key major ♭B with two flats, muſt be tuned chord of fifth below the ſaid ♭B; and ſo on through all the fourths of the keys major with flats. Each fourth in order is to be tuned chord of fifth below the former, reducing the tune to the compaſs of the ſtaff, by introducing an octave when requiſite, till we arrive at ♭Gˋ, at the end of the ſecond diviſion. All the fourths of the keys major with flats ſhall thus be in tune.

The firſt note that ariſes with an acute mark in the ſcales for the tune of the organ is A′, the ſecond of the key major G with one ſharp; and it is tuned, as has been already explained, chord of fifth above D; which D was tuned chord of fourth below G, the fifth of the pitch-note. Thus, therefore, all the ſeconds of the major keys with ſharps may be derived from the pitch-note; each ſucceeding ſecond in order through theſe keys being made chord of fifth above the preceding one: and this operation is continued until all theſe ſeconds are tuned, the laſt being ✳G′ ſtanding at the end of the third diviſion of the tuning-ſcale.

The firſt grave note that ariſes in the progreſs of the keys major is Dˋ (ſee the Scale N° 39.), being the ſixth of the key major F with one flat. This alſo being derived from the pitch-note, after the manner already explained, and marked in the tuning-ſcale in the beginning of the fourth diviſion; the tune of all the ſixths of the keys major with flats may be formed as chords of fifth downwards in their order of ſucceſſion, as directed by the tuning-ſcale, to near the end of the fourth diviſion at ♭Bˋ; which is the ſixth of the key major ♭Dˋ with five flats: to which ♭Eˋ is added, not as the ſixth of any key major, but as the fourth of the key minor with five flats. For it has been ſhewn, that, in the order of the keys with flats, the fourth of each preceding key minor is of the ſame pitch of tune with the ſixth of the ſucceeding key major; and the tune of the ſixths of the ſucceeding major keys have hitherto ſupplied alſo the tune of the fourths of the preceding keys minor. But there being now no ſucceeding key major after the key minor with five flats, this ♭Eˋ muſt be added to the ſcale, to ſhew its own tune as fourth of the key minor with five flats.

Next, let ♮Bˋ, as it ſtands ſixth greater to the key minor Dˋ with one flat, be tuned, (ſee Scale N°42.); and from this proceed to tune the ſixth greater of the key minor Gˋ with two flats, viz. ♮Eˋ, as chord of fifth below the ſaid ♮Bˋ; and ſo go forward through the ſharp ſixths of the minor keys with flats in order, to the end of the fifth diviſion of the tuning-ſcale at ♮Gˋˋ. And in the laſt place, returning to the ſame ♮Bˋ, proceed again by chords of fifths taken upwards through the ſharp ſixths of the minor keys natural and with ſharps, in order, as in the ſixth diviſion of the tuning-ſcale to the end. Thus the inſtrument ſhall contain every degree of tune requiſite to afford true diatonick muſic in all the twenty-four keys.

One reaſon why we return to the tune of ♮Bˋ to begin the laſt diviſion of the tuning-ſcale is, that if the tuning of theſe ſixths greater of the minor keys had begun at the ſignature of ſix ſharps, or of five flats, it would have required a great many preliminary ſteps to be taken before the tune of the firſt ſixth greater of either of theſe keys minor could have been derived from the pitch-note. Add to this, the vaſt train of fifths in ſucceſſion to be taken before we could paſs thro' the whole, the laſt always depending upon the truth of all the former, the riſk would be much increaſed: therefore it ſeemed better to take a departure near the middle, purſuing the operation by one courſe thro' the flats; and, returning again to the ſame note, begin anew, and proceed through the ſharps.

It has been ſaid, that if an inſtrument were tuned with all the tones directed to be found in the tuning-ſcale, it would contain every degree of tune requiſite to afford true diatonick muſic; becauſe, upon examination, it will be found, that the tuning-ſcale contains all the degrees of tune comprehended in the ſcales called the *tune of the organ*, where all the twenty-four keys of muſic are regulated by true diatonick intervals. For beginning with the Scale N° 32. and taking down every degree of tune contained in it belonging to the keys major and minor in naturals, and from theſe proceeding through the whole twelve ſignatures, taking down only afterward, from each, ſuch new degrees of tune as ariſe; when the whole is thus drawn out, it will be found, that the number of degrees, and their pitches of tune, are exactly the ſame with thoſe contained in the tuning-ſcale: See the Scale N° 45. where the firſt double bar contains all the degrees of tune belonging to the Scale N° 32.; a ſingle-bar mark ſeparating the degrees belonging to the major mode, from thoſe additional peculiar to the minor. The ſecond double bar has thoſe additional degrees required by the Scale N° 33. for the ſignature of one ſharp, viz. ※F as the ſeventh, and A′ as the ſecond, of the major; and for the minor, ※Cˋ as the ſixth greater, and ※Dˋ as the ſeventh greater to it. The fourth of this key minor being of the ſame pitch with the ſixth of the key major natural, which is already taken down, muſt not here be repeated. Neither muſt ♯G`, the ſixth greater of the key minor with two ſharps, be repeated in the next double bar for that ſignature; becauſe it is of the ſame pitch with ♯G`, the ſeventh greater of the key minor natural: And ſo of all the reſt of the fourths and ſixths greater of the other keys in ſucceſſion through the progreſs of the keys with ſharps. In taking down the tune peculiar to the ſignature with one flat, D`, the ſixth of the key major, is likewiſe omitted, being of the ſame pitch with D`, the fourth of the key minor natural: and ſo of the reſt in proceeding through the ſignatures with flats; where the omiſſions are uniform, and the principle ſo plain, that there ſeems no need of further explanation.

The degrees of tune contained in this tuning-ſcale being numbered, excluſive of the repetition of ♮B`, which appears once in the firſt bar of the fifth diviſion, and again in the firſt bar of the ſixth diviſion, are in all forty-four degrees of tune. And thus, inſtead of twelve degrees of tune in the common computation of the octave, there muſt be no leſs than forty-four furniſhed for putting an inſtrument in diatonick tune; or if both extremes of the octave be included, inſtead of thirteen, there muſt be no leſs than forty-five. Although it probably will ſeem amazing to ſuch as are verſant in the ſubject, that this ſhould be accompliſhed by ſo ſmall a number of degrees, there is no doubt mere performers will be alarmed becauſe it is ſo great. Indeed, if no other method could be deviſed than furniſhing a finger-key to each tone of the inſtrument, we might give ourſelves up to deſpair, notwithſtanding the aſſertion of thoſe violin-performers who, pretending to draw true tune from that inſtrument, really undertake a taſk of much greater difficulty. For they muſt not only take all theſe preciſe given intervals, varying according to the change of the keys, but alſo find them in an immenſe variety of proportions; for, in every different ſituation of the hand upon the finger-board, the proportional diſtance of the ſtop alters.

CHAP. III.

Of the Table collecting and eſtimating the ſeveral degrees of tune; and a further view of the elements of muſic.

IT ſeems proper next to collect the different degrees of tune which belong to each finger-key, and to arrange them in the order of their pitch. For, upon looking into the tuning-ſcale N° 44. or into the ſcales for the tune of the organ, N° 32. to 43. it will be found, that ſeveral degrees of tune muſt be aſſigned to each finger-key, as they appear placed in the following Table.

TABLE collecting the Degrees of Tune belonging to each Finger-key.

The finger-key repreſenting the notes called	muſt repreſent and produce
※B or C	C, C`, ※B°,
♭D or ※C	※C′, ※C, ※C`, ♭D`,
✠C or D	D, D`, ♮D``, ✠C°,
♭E or ※D	※D, ※D`, ♭E, ♭E`,
E	E′, E, E`,
※E or F	F, F`, ※E′, ※E°,
♭G or ※F	※F′, ※F, ※F`, ♭G`,
✠F or G	G, G`, ♮G``, ✠F°,
♭A or ※G	※G′, ※G, ※G`, ♭A,
A	A′, A, ♮A`,
♭B or ※A	※A′, ※A°, ♭B, ♭B`,
B	B′, B, ♮B`.

The above table ſhews, that never leſs than three, but oftener four, degrees of tune belong to one finger-key: What are their differences, and conſequently how great the errors of the preſent inſtruments, which afford only one note indiſcriminately for the whole, ſhall be preſently ſhewn.

Although every degree of tune requiſite

to produce true diatonick muſic be now found, we are ſtill ignorant of many of their relative degrees of pitch.

For example: Although it be known that C is comma acuter than Cˋ, yet ſtill we are ignorant whether ※B°, which belongs to the ſame finger-key, is ſharper or flatter than either of them. And as the method contrived for computing this is uncommon, the operation by which the difference of theſe degrees of tune belonging to the finger-key C natural is found, ſhall be ſet down as an example, which will point out the way to find the reſt. It will likewiſe ſhew how the degrees of tune contained in the tuning-ſcale N° 44. may be compared with the Scales N° 32. to N° 43. to prove, that the tune of the organ, prepared to give the twelve ſignatures, containing twenty-four keys major and minor, in true diatonick relation in all its degrees, is comprehended in the tuning-ſcale; and that, excluſive of the repetition of the pitch-note in octave, forty-four degrees of tune are required, and no more.

For a reaſon which ſhall be afterwards aſſigned, in the following operation, we muſt not calculate from the pitch-note to the others belonging to the ſame finger-key directly; but rather from the pitch-note to its octave, and to the octaves of the others.

The interval between C and its octave is three tones greater, two tones leſſer, and two ſemi-tones; and turning to the tuning-ſcale N° 44, *B° is found tuned in the laſt diviſion of that ſcale. In the beginning of that diviſion,

	G.	L.	S.
The firſt ſtep taken is from C to F, marked above, chord of fourth, which by the Scale N° 3. contains -	1	1	1
The ſecond ſtep from F to D` is chord of ſixth greater, - - -	2	2	1
Therefore the interval between C and the octave of D` is - -	3	3	2
The third ſtep taken downwards muſt be ſubtracted, being that from D` to ♮B`, marked above, third leſſer, -	1	0	1
The remainder, being the interval between C and ♮B`, is - -	2	3	1

	G.	L.	S.
Brought over, Interval between C and ♮Bˋ,	2	3	1
Add the fourth ſtep, ♮Bˋ to ※Fˋ, chord of fifth, - - -	2	1	1
The interval between C and the octave of ※Fˋ contains - - -	4	4	2
Subtract an octave, to free the calculation from large terms - -	3	2	2
C is to ※Fˋ - - -	1	2	0
Add the fifth ſtep from ※Fˋ to ※Cˋ, chord of fifth, - - -	2	1	1
C is to the octave of ※Cˋ -	3	3	1
Add the ſixth ſtep from ※Cˋ to ※Gˋ chord of fifth, - - -	2	1	1
C to the octave of ※Gˋ is -	5	4	2
Subtract an octave -	3	2	2
C is to ※Gˋ - -	2	2	0
Add the ſeventh ſtep from ※Gˋ to ※Dˋ, chord of fifth, - -	2	1	1
C is to the octave of ※Dˋ -	4	3	1
Add the eighth ſtep from ※Dˋ to ※A°, chord of fifth - -	2	1	1
C is to the octave of ※A° -	6	4	2
Subtract an octave -	3	2	2
C to ※A° is - -	3	2	0

	G.	L.	S.
Brought over, C to ✻A° is -	3	2	0
Add the ninth ſtep from ✻A° to ✻E°, chord of fifth, - - -	2	1	1
C to the octave of ✻E° is -	5	3	1
Subtract an octave -	3	2	2
C to ✻E° is - -	2	1	—1
Add the tenth ſtep from ✻E° to ✻B°, chord of fifth - - -	2	1	1
C to the octave of ✻B° is -	4	2	0

In ſubtracting the laſt octave, it became neceſſary to uſe the ſign (—) minus; becauſe otherwiſe two ſemi-tones could not be ſubtracted from one. The ſemi-tone which has this ſign prefixed means, that there is a ſemi-tone wanting in the ſum: and when the next ſtep which has a ſemi-tone belonging to it falls to be added, they deſtroy each other, and their ſum is nothing.

Thus it appears, that C is to the octave of ✻B° an interval of four tones greater and two tones leſſer. And becauſe C` is comma flatter than C the pitch-note, which comma is the difference between tone greater and tone leſſer; if from the ſum of the interval between C and its octave a tone greater ſhall be taken, and a tone leſſer put in its place, it will give the ſum of the interval between C and the octave of C`, that is, two tones greater, three tones leſſer, and two ſemi-tones; and theſe three pitches of tune will ſtand thus:

	G.	L.	S.
The octave of C, the pitch-note,	3	2	2
——— of ※B° to the ſame pitch-note, -	4	2	0
——— of C` to the ſame,	2	3	2

	G.	L.	S.		G.	L.	S.
Thus the octave of C to C is	3	2	2	of ※B° to C is	4	2	0
From each ſubtract	3	2	0	———	3	2	0
Remains	0	0	2	Remains	1	0	0

Hence, after an equal ſubtraction is made from the interval of C to its octave, and from the interval of C to the octave of ※B°; the remainder in the former caſe is two ſemi-tones; in the latter, one tone greater. And it is plain, that whichever of theſe two remainders is greateſt, the degree of tune of which it is the remainder, muſt be the moſt acute.

The ratio which repreſents the interval called *ſemi-tone* is 15 : 16; and that ratio added to itſelf gives the ratio 225:256, which is the ſum of two ſemi-tones. The ratio of tone greater is as 8 to 9; which, ſubtracted from the former, leaves the remaining ratio of 2025 : 2048 : therefore the interval which is the ſum of two ſemi-tones, exceeds the interval of tone greater by this laſt ratio; and conſequently C is acuter than ♯B°.

In the ſame way, the interval of two tones greater, compared with the interval of one tone leſſer added to two ſemi-tones, is computed: the firſt of which is the remainder of the ſum of the octave of ♯B° to C the pitch-note; and the other is the remainder of the ſum of the interval of the octave of C', alſo to C the pitch-note, after an equal ſubtraction has been made from both. And hence it is found, that the interval of two tones greater exceeds the interval of one tone leſſer added to two ſemi-tones by the ratio 32,805 : 32,768;

and conſequently, that 𝄪B° is acuter than C‵ by that ratio. This may be proved by adding the ratio 2025 : 2048 to the ratio 32,768 : 32,805, and their ſum will be found equal to the ratio 80 : 81, which is comma, already known to be the difference of C and C‵.

The reaſon for the marks of the degree of tune aſſigned to the ſixth greater of the minor mode in four flats may not perhaps ſeem very obvious, (ſee the Scale N° 42.) It ſhall therefore be likewiſe explained by the above method of computation; hoping that this, with the former, may ſuffice as examples to direct to the manner of examining the propriety of the marks by which any other of the degrees of tune are diſtinguiſhed.

♮D‶, the pitch of which is now under examination, is regulated as chord of ſixth greater above, or as chord of third leſſer below F‵; but F is the fourth of the natural key major C; and therefore the interval between C and F is one tone greater, one tone leſſer, and one ſemi-tone.

But F' is comma flatter than F; therefore the interval between C and F' is two tones leſſer, and one ſemi-tone, $\overset{G.}{0}\,\overset{L.}{2}\,\overset{S.}{1}$: add to this the chord of ſixth greater, $\overset{G.}{2}\,\overset{L.}{2}\,\overset{S}{1}$, the ſum is $\overset{G.}{2}\,\overset{L.}{4}\,\overset{S.}{2}$, being the quantity contained in the interval between C and the octave of ♮D'': from which ſum, could an octave be directly ſubtracted in diatonick elements, the remainder would be the interval between C and ♮D''. But as this is impoſſible, the remainder muſt be found, after making the greateſt poſſible equal ſubtraction in elements from the ſum of the interval of the octave to C, and from the ſum of the interval of the octave to ♮D''. Thus

	G.	L.	S.		G.	L.	S
C is to the octave of ♮D''	2	4	2,	and C is to its own octave	3	2	2
Subtract from each	2	2	2	————————	2	2	2
Remains	0	2	0	Remains	1	0	0

Now, to gain a complete idea of the interval between C and ♮D'', it is neceſſary to ſuppoſe a tone greater to be ſubtracted from two tones leſſer; and it is plain the remainder would be, one tone leſſer minus comma: therefore this laſt quantity is the true interval between C and ♮D‶. But D without the grave mark is tone greater to C: therefore ♮D‶ is double comma flatter than D; and conſequently it is juſtly ſigned.

But although it be clear, that ♮D‶ ought to be thus marked when written in any ſtaff of muſic-lines, upon the beginning of which there happens not to be a grave mark ſtanding upon the place of D; yet the ſtrict propriety of adding the double grave mark may be doubted when the ſignature already contains one of theſe grave marks. In this caſe, perhaps, it ought only to have one ſingle grave mark as an addition to the ſignature: But we follow the method often uſed for diſtinguiſhing the double ſharps, and think it leſs liable to miſtake.

The following Table of Comparative Degrees is calculated by the above method.

TABLE ſhewing the Comparative Degrees of Pitch of Tones belonging to each Finger-key of the Organ.

Finger-keys.	Notes.		Diſtances in diatonick degrees from the pitch-note.			Ratio in numbers.	Difference in diatonick degrees.					
							G.	L.	S.	G.	L.	S.
※B or C	C	whole octave above the pitch-note is	3	2	2	2048/2025	0	0	2			
	※B°		4	2	0	32805/32768	1	0	0	2	0	0
	C`		2	3	2					0	1	2
♭D or ※C	※C′		5	1	1	81/80	1	0	0			
	※C		4	2	1	32805/32768	0	1	0	2	0	0
	♭D`		2	3	3	2048/2025	0	0	2	0	1	2
	※C`		3	3	1		1	0	0			
✠C or D	D		4	2	2	2048/2025	0	0	2			
	✠C°		5	2	0	32805/32768	1	0	0	2	0	0
	D`		3	3	2	81/80	1	0	0	0	1	2
	♮D``		2	4	2		0	1	0			
♭E or ※D	※D		5	2	1	32805/32768	2	0	0			
	♭E		3	3	3	2048/2025	0	1	2	0	0	2
	※D`		4	3	1	32805/32768	2	0	0	0	1	0
	♭E`		2	4	3		0	1	2			
E	E′		5	2	2	81/80	1	0	0			
	E		4	3	2	81/80	0	1	0	1	0	0
	♮E`		3	4	2					0	1	0
※E or F	※E′		6	2	1	32805/32768	2	0	0			
	F		4	3	3	2048/2025	0	1	2	0	0	2
	※E°		5	3	1	32805/32768	2	0	0	1	0	0
	F`		3	4	3		0	1	2			
♭G or ※F	※F′		6	2	2	81/80	1	0	0			
	※F		5	3	2	32805/32768	0	1	0	2	0	0
	♭G`		3	4	4	2048/2025	0	0	2	0	1	2
	※F`		4	4	2		1	0	0			
✠F or G	G		5	3	3	2048/2025	0	0	2			
	✠F°		6	3	1	32805/32768	1	0	0	2	0	0
	G`		4	4	3	81/80	1	0	0	0	1	2
	♮G``		3	5	3		0	1	0			
♭A or ※G	※G′	whole diſtance above the pitch-note is	4	0	0	81/80	1	0	0			
	※G		3	1	0	32805/32768	0	1	0	2	0	0
	♭A		1	2	2	2048/2025	0	0	2	0	1	2
	※G`		2	2	0		1	0	0			
A	A′		3	1	1	81/80	1	0	0			
	A		2	2	1	81/80	0	1	0	1	0	0
	♮A`		1	3	1					0	1	0
♭B or ※A	※A′		4	1	0	32805/32768	2	0	0			
	♭B		2	2	2	2048/2025	0	1	2	0	0	2
	※A°		3	2	0	32805/32768	2	0	0	1	0	0
	♭B`		1	3	2		0	1	2			
B	B′		4	1	1	81/80	1	0	0			
	B		3	2	1	81/80	0	1	0	1	0	0
	♮B`		2	3	1					0	1	0

The firſt column ſhews the letters and ſigns by which the finger-keys of a harpſichord or organ are preſently named. The ſecond ſhews the degrees of tune as they ought to be repreſented by letters and ſigns: thoſe aſſigned to each finger-key being bound together by hooks. The fourth ſhews the ſum of the elements contained between the pitch-note C and each of the other degrees of tune. The fifth ſhews the ratios in numbers between each two contiguous degrees of tune belonging to the ſame finger-key. And the ſixth and ſeventh ſhew the differences in elements, after the greateſt poſſible equal ſubtraction has been made from every two terms, as in the above operation.

But obſerve, that as the middle tones ſtand in different degrees of relation to thoſe above and below, the difference of the firſt and ſecond tone in every group is put in the ſixth column; the difference of the ſecond and third is put in the ſeventh; and of the third and fourth, again, is put in the ſixth.

Before this table is conſidered, it is proper likewiſe to obſerve, that, to afford room for marking the differences of the degrees of tune repreſented by each finger-key in poſitive numbers of elements, it is neceſſary for ſome time, inſtead of their immediate relation to the pitch-note C, to aſſume their reſpective octaves; till, by aſcending from C, the computation ſhall arrive at a ſufficient diſtance to afford terms for calculating their differences, without the neceſſity of uſing the negative ſign in marking the ſums.

To explain this, let it be conſidered, that C, the pitch-note, (as it has been ſhewn in the above calculation), is the acuteſt of all the degrees of tune belonging to that finger-key. And if the computation had not been made by the interval between that pitch-note and the octaves of the other tones belonging to the ſame finger-key, the intervals between it and the other degrees of tune could not have been expreſſed by any other means than by negative ſigns, becauſe they are all flatter.

It therefore becomes neceſſary to take the interval which the pitch-note makes with its own octave, and with the octaves of the other notes; and by this means we find terms to expreſs the differences in elements. This muſt be continued till we reach the finger-key ※G. For ※F°, which is one of the tones belonging to the finger-key G, makes an interval with C, the ſum of which is $\overset{\text{G. L. S.}}{3+1-1}$. This ſum cannot be expreſſed without the negative ſign: but if an octave be added, there is no occaſion, and it ſtands as in the Table, $\overset{\text{G. L. S.}}{6:3:1}$. Afterwards it becomes unneceſſary to continue to add the octave, being now arrived at a ſufficient diſtance from the pitch-note to afford terms to calculate by, and to ſhew their ſimple intervals to C.

The reader need not be ſurpriſed when, in the Table of comparative degrees, ſometimes a letter, which ſtands naturally next below another, after it has received a ſharp mark, will ſtand higher than that

other,

other, after that other has received a flat mark. An inſtance of this may be found in the degrees of tune belonging to the finger-key for ♭A or ※G. There ※G ſtands higher than ♭A. The interval between G and A, in their original pitch, as fifth and ſixth of the natural key C, is tone leſſer. But ♭A, by the flat mark annexed, is reduced limma major lower than the original pitch of A; and G, by the ſharp mark, is equally raiſed. And, upon trial, it will be found, that the ſum of two limmas major added is a ratio of 16384:18225; from which ſubtract a tone leſſer 9 : 10, (the original interval between G and A), and the remainder is a ratio of 32768 : 32805. The ſum of two limmas major, therefore, exceeds the tone leſſer by the laſt mentioned ratio; and conſequently the two letters thus ſigned muſt change their ſituation in the rank of pitch. But, in other like circumſtances, where the rank of the letters continues as they originally ſtood, it will be found, that their natural interval was tone greater; and by calculation it will be found, that the ſum of two limmas major is not equal to the tone greater: therefore the letters muſt ſtill keep their original rank.

Thus the degrees of tune requiſite to complete a ſyſtem of notes for twenty-four keys, tuned by the true intervals of the diatonick ſcale, are diſcovered. And if it ſhall appear, that theſe degrees ſerve not only for this purpoſe, but alſo furniſh the means of correcting what have been held the internal defects of the ſcale, perhaps the ratios which theſe degrees of tune ~~may~~ diſcover may likewiſe be intitled *elements of tune*. They are as follows:

ELEMENTS of TUNE.

1*ſt*, *Tone greater*, a ratio of	8 to 9
2*d*, *Tone leſſer*, a ratio of	9 to 10
3*d*, *Elementary ſemi-tone*, a ratio of -	15 to 16
4*th*, *Limma major*, being the difference between tone greater and ſemi-tone, a ratio of	128 to 135
5*th*, *Limma minor*, be-	

ing

ing the difference between tone leſſer and ſemi-tone, a ratio of -	24 to 25
6*th*, *Comma*, a ratio of	80 to 81
7*th*, *Dieſis major*, being the difference between the ſum of two ſemi-tones and tone greater, a ratio of	2025 to 2048
8*th*, *Dieſis minor*, being the difference between the ſum of two tones greater, and the ſum of one tone leſſer added to two ſemi-tones; or the difference between one tone leſſer, and the ſum of two limmas major, a ratio of	32768 to 32805

The terms *limma* and *dieſis* are retained, as being uſed by writers upon muſic, altho' hitherto without accuracy.

It may be proper, however, here to take notice, that although theſe elements are all that ariſe naturally in proſecution of the preſent plan of inquiry, there are beſides many more which might be added.

CHAP. IV.

General plan of an organ capable of true diatonick tune in all its keys.

THE relative pitch of the ſeveral degrees of tune belonging to each finger-key being thus aſcertained, we are enabled to arrange them as they ought to ſtand in their places upon the inſtrument. Suppoſing them to be repreſented by organ-pipes, it is plain, that the pipes to be affected by each finger-key muſt be placed in a row from the front to the back of the inſtrument; at leaſt this ſeems the moſt natural manner of placing them; and that row of pipes muſt contain all the different degrees of tune which the Table ſhews are required from the finger-key.

As many of the finger-keys muſt produce four different degrees of tune, the pipes may farther be ſuppoſed to be arranged in four rows, in a tranſverſe direction. Theſe tranſverſe rows will have ſeveral vacancies, owing to the unequal number of tones required to be produced by the different finger-keys. See this order repreſented in Scale N° 46. called *General arrangement of tune upon the organ:* where the rows from the front to the back of the organ are repreſented by notes contained between the ſingle lines drawn acroſs the ſtaves in form of muſic-bars, and the tranſverſe rows are repreſented by the notes that fall upon each of the ſeveral ſtaves; the acuteſt tune being placed higheſt, and the reſt below, in the order of their pitch.

The degrees of tune being thus arranged, it remains to be conſidered how they ſhall be fitted for practice. The method firſt to be propoſed is by a ſet of ſtops, to be afterwards deſcribed.

To explain the operation of theſe ſtops, it ſeems neceſſary to draw ſcales for each of the twenty-four keys of muſic: In each of which ſhall only be marked the degrees of tune belonging to the key which it repreſents, placed as in the general arrangement of tune; and all the places of the other degrees which are extraneous to the key repreſented, ſhall be left blank. Theſe ſcales, to diſtinguiſh them from the others, ſhall be called, *Particular arrangement of tune;* (ſee the Scales from N° 47. to N° 70.)

It may be obſerved, that although it ſeems neceſſary that the ſeveral degrees of tune belonging to each finger-key ſhould ſtand in the ſituation they are placed in theſe ſcales, in the rows from front to back; that ſo, each being on a line with the finger-key to which it belongs, it may be in the beſt ſituation to be affected by it; yet there is no neceſſity to continue the order they hold in the tranſverſe rows. For any of the degrees of tune may be placed more towards the front or back of the inſtrument, at pleaſure, if ſuch an alteration ſhall be found to afford any advantage to the organ-builder in forming the ſtops.

The degrees of tune belonging to all the keys being now diſtinctly known, and their ſituation upon the inſtrument pointed out, the general and particular ſcales of arrangement being alſo underſtood, the ingenious inſtrument-maker may be ſufficiently enabled to form a ſet of ſtops fit to open the whole tune belonging to any particular key, at pleaſure; the other pitches being all, of conſequence, thrown off. The hand of the performer is employed to manage the ſtops of the organ in its preſent form, which muſt ſometimes interrupt the performance; but ſurely it would be more convenient to uſe the foot. And as there are twelve different ſignatures of keys, ſo there muſt be twelve different places for the ſtops, which may be arranged along the front baſe of the inſtrument, ſix on the right, and ſix on the left: but to each of theſe places there muſt be two ſtops, one for the major, and one for the minor mode.

The *ſtop-keys* (as they may be called) ſhould be made in the form of finger-keys, but much larger, ſtanding at a proper diſtance from each other. The ſtop-keys for the major mode may be made of a conſiderable length, and placed in a row neareſt the ground; another row of ſtop-keys, formed ſhorter, being placed over them for the minor keys. Each minor ſtop being placed directly over the major of the ſame ſignature, the whole will ſtand in ſo diſtinct a form, that there will be ſmall hazard of miſtake.

CHAP. V.

Of the internal intervals of the diatonick ſcale; and of the falſe intervals corrected.

AN inſtrument, conſtructed upon the preceding plan, may be ſaid to contain true tune; becauſe all its intervals in each key are perfectly adjuſted according to the natural intervals of the diatonick ſcale.

Although every degree of the diatonick ſcale, compared with the key-note, has ſtood the teſt of the ſevereſt examination; yet there are ſeveral falſe intervals, when compared with one another. Theſe have been conſidered as internal defects inherent in the nature of tune, and which it is impoſſible to remove.

Innumerable and ineffectual have been the attempts to reconcile theſe jarring elements; and every effort made has iſſued in ſome propoſal to palliate, not to eradicate the evil.

It may be beſt firſt to ſurvey theſe defects; and then, lending an ear to the voice of nature, to follow where ſhe may be pleaſed to lead. See fig. 71, 72, 73, 74.

In all theſe figures, called *orders of the chords*, it is eaſy to compute from each term to another, by the letters G, L, S, what is the interval between the terms connected by the curve lines: and from the Scales N° 3 and 4. it may be found whether they contain true or falſe quantities. Theſe orders are continued thro' two octaves, and two octaves muſt contain all the variety that can exiſt. Indeed there are ſeveral needleſs repetitions in the ſecond octave of each of the orders, to ſhew the return of the ſame courſe of intervals which appeared in the firſt.

In the order of thirds, (fig. 71.), the interval between the ſecond of the key and the fourth is marked 3d\` leſſer; the grave mark being added to ſhew that it is leſs than the true chord of third leſſer by comma. The interval between the ſecond and fourth contains a tone leſſer and a ſemi-tone; whereas the true chord of third leſſer contains a tone greater and a ſemi-tone: and this is the only falſe interval in the thirds.

In the fourths, (fig. 72.), there are two falſe intervals; one between the fourth and the ſeventh, which contains two tones greater and one tone leſſer. This interval being limma major too large, is marked (*) to diſtinguiſh it. Alſo the interval between the ſixth and the ſecond of the key, conſiſting of two tones greater and one ſemi-tone, is marked with an acute mark, to ſhew that it is comma too large. All the others are true chords of fourth.

In the fifths, (fig. 73.) there are likewiſe two falſe intervals: One between the ſecond and the ſixth of the key, which contains one tone greater, two tones leſſer, and one ſemi-tone; which is comma leſs than the true chord of fifth, and is therefore marked with a grave mark: Another between the ſeventh and the fourth of the key, containing one tone greater, one tone leſſer, and two ſemi-tones; which is limma major leſs than the chord of fifth, and therefore has a flat mark.

In the ſixths, there is only one falſe interval, between the fourth and the ſecond of the key; which containing three tones greater, one tone leſſer, and one ſemitone, is comma too large: it has therefore an acute mark.

If the preceding ſyſtem of tune ſhall furniſh the means of correcting theſe falſe intervals, and alſo lead to the diſcovery of ſome beautiful properties of tune hitherto unknown, it is probable that the ſolution of the great problem for attaining true tune will be allowed to be accompliſhed.

Compoſers ſcruple not to admit the ſecond and fourth of any key to ſtand in counter-point, either as chord of third or of ſixth; and the effect in that caſe is as agreeable as theſe chords are known to produce in any other part of the ſcale upon the harpſichord or organ, where they are tempered, and by no means perfect; but upon the violin, or in ſinging, they are meant to be taken perfect, or as nearly ſo as the performer is able. In the preſent indiſcriminate method, it is not perhaps eaſy to ſay, whether, in performance, the ſecond is flattened comma, or the fourth raiſed comma, or if both are ſomewhat altered. The pitch of the fourth ſeems to be ſtrongly marked, being a conſpicuous concord to the key-note as well as to many other notes belonging to the key, (we ſpeak not now of its character in compoſition, but only of its place in the Scale): and therefore any alteration of it would ſurely be hurtful. To divide the error, and alter both ſecond and fourth, impairs both.

It would ſeem, that the whole alteration ſhould be upon the ſecond, making it occaſionally tone leſſer to the key-note inſtead of tone greater, as the combination of the ſecond and fourth, or of other notes to be mentioned, ſhall occur. This will give true concord, without mangling any of the elements of tune.

It has been much agitated, whether tone leſſer or tone greater ſhould be placed next the key-note? Different ſides have been taken by great theoriſts. Reaſon as well as experiment ſeem to leave the matter undecided and perfectly in equilibrio: cuſtom alone has given the preference to tone greater. When tone greater is next the key-note, the ſecond ſtands in true concordant relation to the fifth and ſeventh of the key, and is falſe to the fourth and ſixth: When tone leſſer is next the key-note, the ſecond ſtands in true concordant relation to the fourth and ſixth of the key, but is falſe to the fifth and ſeventh.

Where circumſtances are ſo equal, it cannot be doubted that nature has meant the ſecond ſhould be changeable. Analogy likewiſe ſeems to indicate this change: for the ſevenths, which are complements to the ſeconds, are acknowledged to be changeable in the key minor; and, for a reaſon to be afterwards given, perhaps they may likewiſe be found changeable in the key major. We ſee already, that the ſecond of the key major is in a fluctuating ſtate in every ſignature between its pitch as ſuch, and as fourth of the key minor.

This kind of reaſoning might be carried much further: but although it may corroborate, it cannot decide; therefore appeal is to be made to actual experiment, which, in all ſuch caſes, muſt be the ultimate ~~judge~~. resource

Happily an organ, conſtructed after the foregoing plan, permits this change with the greateſt eaſe: for if the muſic be in the greater mode, the performer has only to touch the ſtop-key of the minor of the ſame ſignature, and it makes the change required, without affecting the tune of the key in any other reſpect.

But what ſhall be ſaid, if, by this ſingle operation, the whole errors of tune found in the preceding orders of the chords ſhall be perfectly corrected? Will it not give ſuch ſanction to this law of tune, that it were almoſt a crime to doubt? And will not an inſtrument, conſtructed upon theſe principles, prove the faithful handmaid of nature?

The only falſe third in the whole ſyſtem being corrected as above, the falſe fourth, between the ſixth and the ſecond, being comma too ſharp, is alſo corrected by flattening this ſecond of the key. The falſe fifth between the ſecond and the ſixth, which is comma defective, by the ſame flattening of the ſecond is likewiſe corrected. So alſo is the falſe ſixth between the fourth and the ſecond, which being comma too ſharp, the flattening of the ſecond corrects it. For it ſo happens, that, in all thoſe falſe intervals which are defective by comma, the ſecond of the key is the loweſt term; and hence, by flattening it, the intervals are increaſed to their juſt quantity: and when the falſe intervals are too large by comma, then the ſecond being the higheſt term, by flattening it they are reduced to their juſt quantity.

There only now remains the falſe fourth between the fourth and ſeventh of the key, which is limma major too large; and the falſe fifth between the ſeventh and the fourth of the key, defective by the like quantity; the one being the complement of the other. But the correction of theſe demands no operation for altering the tune of the inſtrument: For the natural key major C being the given key, ♭B, the fourth of the key major F with one flat, is limma major flatter than B, the ſeventh of the given key; and this ♭B ſtanding ready to be taken upon its proper ſeparate finger-key, will give the note required. The ſucceſſion of the keys as they ſtand in order, from ſix ſharps to five flats, being all perfectly uniform, the fourth of each ſucceeding key major in that order is marked as an additional note upon the arrangement of the tune of each key major; for it is in the true pitch as flat ſeventh to each of theſe keys.

This explains the meaning of the ſecond ſtaff for the major mode in the ſcales for the tune of the fiddle, marked flat ſevenths and grave ſeconds. Theſe grave ſeconds of the major mode are the ſame with the notes which are the fourths proper to the minor mode: and the flat ſevenths being tuned chord of fifth below the fourths of each key, or chord of fourth above them, a more particular account of their regulation for the fiddle ſeems needleſs.

But when we arrive at the key major with five flats, the laſt key major in this order, there is then no ſucceeding key, the pitch of the fourth of which may be taken as a flat ſeventh to this key major; nor is there any degree of tune in the ſyſtem which exactly correſponds to it: therefore, if it muſt be procured, a ſupplementary note, which will be a flat C, muſt ſtill be added, to anſwer that ſingle purpoſe; and it muſt be tuned chord of fifth below the fourth of the key. This would give the true pitch required, being dieſis major acuter than ♮B`; and in arranging the tune upon the organ, this degree of tune would properly ſtand upon the ſecond ſtaff from the foot of the ſcales of arrangement, and in the diviſion belonging to the finger-key B; while B and B′ would be removed each one ſtaff higher.

It may be noticed, that the want of a ſupplementary note does not ſhew any defect in the ſyſtem of tune. For it is plain, that if the ſame courſe were ſtill to be purſued to form a key with the ſignature of ſix flats, that key would afford the note wanted: it is alſo plain, that this train would lead to an infinite ſeries of new keys in either direction. But this obſervation points only at one of the ſimpleſt and leaſt important circumſtances of which theſe new ideas of tune ſeem to promiſe a diſcovery, if a more advanced inquiry ſhould be entered upon.

CHAP. VI.

Objections to the conſtitution of the Scale removed; the diverging nature of tune explained, and the manner of preſerving or reſtoring the original pitch.

HAVING explained the nature of the organ, we next endeavour to ſhew, that the ſcale of muſic is free from ſome other imperfections that have been conceived to exiſt in it; and to anſwer ſome objections, founded upon certain particular phenomena hitherto unexplained.

It muſt be obſerved, that, in forming the preceding ſyſtem of tune, the common language of theory has been uſed, as if that theory had been received by univerſal conſent, which is not the caſe. The difficulties which have been already ſtated and removed, have always been regarded as real inconſiſtencies inherent in the conſtitution of the Scale. Demonſtrations have been delivered, by very many of the greateſt theoriſts, of the impoſſibility of removing them; and hence the truth of the principles has been ſuſpected. No wonder, then, if, beſides the objections ariſing from ſuch facts, others, founded on conjecture, ſhould have been added, and which alſo muſt be removed. But, in the mean time, let it be conſidered, that ſince this ſyſtem of tune is ſtrictly ſubjected to the judgment of the ear, and ariſes from experiments actually made upon the violin, all perfectly agreeing with theory; it would have been unreaſonable ſcepticiſm to have refuſed to adopt doctrines ſo well confirmed and ſuited to the preſent purpoſe.

One capital difficulty, however, ſtill remains, which if once removed, the remaining objections might be left to receive their anſwer from the inſtrument itſelf; for it is not doubted but that it will ſpeak home in ſuch glowing harmony as muſt bring irreſiſtible conviction.

The neglect of the difference between tone greater and tone leſſer in practice, and of other circumſtances already noticed, has occaſioned much falſe compoſition; and falſe compoſition, although performed upon an inſtrument whoſe tune is abſolutely perfect, muſt ſtill yield imperfect muſic. In order, therefore, to vindicate this ſyſtem of tune from the charge of errors which may be diſcovered when ſuch an inſtrument as has been deſcribed may be employed to perform ſuch compoſitions; and alſo, to put future compoſers upon their guard; notice ſhall be taken of an obſervation made by Mr Huygens, which will throw a clear light upon the matter. It will likewiſe explain a phenomenon which has hitherto been conceived to indicate another inconſiſtency in the principles of muſic, but which is the link which connects the whole, and binds the parts together in one continued chain.

Mr Huygens obſerves, that if a perſon ſing the notes C, F, D, G, C, alternately aſcending and deſcending by perfect intervals, the laſt note C will be flatter by a whole comma than the note C with which the ſinger begun.

Many other *chaunts* (as they may be called, after the example of Mr Huygens) might be compoſed of the degrees of the diatonick ſcale, all producing ſimilar effects; ſome raiſing, and others depreſſing the pitch of the key-note: The chaunt C, A, D, G, C, producing exactly the ſame effect with that remarked by Mr Huygens; and C, G, B, C, if ſung in perfect concordant intervals, alternately deſcending and aſcending, would alter the pitch of the latter C by no leſs than the full elementary ſemi-tone. If the one of theſe is charged as a defect or inconſiſtency in the ſcale of muſic, ſo muſt the others: but the laſt being moſt remarkable, could not eſcape the notice of muſicians; and though well known to them, it has never been ſtated as a blemiſh in the ſcale, becauſe it is known how the tune may be led into concord with the key-note by the interpoſition of other notes. But, in Mr Huygens's chaunt, this difference of comma being hitherto neglected in practice, and its laws not attended to nor underſtood, the diſcovery of its effect ſtriking him with ſurpriſe, he conſidered it as an unaccountable circumſtance, occaſioning a real blemiſh, or at leaſt inconſiſtency. And this notion has continued to miſlead all who have conſidered the matter ſince his time.

But it is plain from all that has been ſaid, that it is only by tracing the progreſs of tune by perfect intervals, properly choſen, the nature of which is to diverge from the immediate concordant relation of the ground-note, that we have been enabled to join the whole twenty-four keys of muſic in one uninterrupted chain, whoſe links are all, in Mr Huygens's own words, "*intervalla conſona omnino perfecta.*" It is equally plain, that, by the ſame means uſed to diverge from the direct concordant relation of the ground-note, the tune may likewiſe converge or be reſtored to it. Thus, in the laſt chaunt C, G, B, C, if the notes D and G be interpoſed between B and the laſt C, the pitch of the fundamental note will be perfectly reſtored: and C, G, B, D, G, C, is a chaunt which, if ſung in perfect concordant intervals, will lead to the preciſe pitch of tune from which it ſet out. So alſo, with reſpect to Mr Huygens's chaunt, C, F, D, G, C, we know, from what has been ſaid upon the regulation of tune, that if D\`, the ſecond of the key, be tuned perfect chord of third downwards from F, the fourth of the ſame key, the interval between D\` ſo tuned, and the key-note C, muſt be tone leſſer. Therefore, to mark the pitch of D in Mr Huygens's chaunt with preciſion, it muſt have the grave mark; and the chaunt will ſtand thus: C, F, D\`, G\`, C\`. For G and C muſt alſo have the grave mark, the tune of theſe laſt notes being thus flattened comma below their pitch as fifth and key-note. If, then, another D\` is made chord of fifth above G\`, this laſt D\` ſhall be a juſt octave to the firſt D\`; and from this D\` to F above it there is a juſt interval of chord of third, or to F below there is a juſt interval of chord of ſixth: and again, from F to C, the interval is juſt chord of fourth or chord of fifth, as the ſtep is taken aſcending or deſcending; and the original pitch of C will thus be perfectly reſtored, and the chaunt will ſtand as follows: C, F, D`, G`, D`, F, C. This chaunt may proceed by perfect concordant intervals, whether the notes are taken in ſucceſſion upwards, downwards, or alternately, and ſtill reſtore the preciſe pitch of the firſt C or of its octave. And by the like means may the tune of the ground of the chaunt C, A, D`, G`, C`, or the tune of the ground of any other diverging ſeries of concordant intervals, be perfectly reſtored, let the caſe be as it will.

In giving the above examples, it is not meant to dictate to compoſers, whoſe feelings and experience, after they are well acquainted with the effects of this refined ſyſtem of tune, will beſt inform them how far ſuch diverging proceſs of tune may be admitted into compoſition, and by which of the ſeveral means which the ſyſtem afſords it ought to be reſtored: but only to ſhew, that there is, in the nature of the thing, no impoſſibility of proceeding in any direction, and to any diſtance [redacted] from the immediate concordant relation to the ground-note, by perfect concordant intervals; and alſo of returning by them to the original pitch. For how indeed can it be otherwiſe, when every ſingle pitch of tune in the whole range of keys has been ſhewn to be genuinely derived from one ground-note; and conſequently they are all truly related to each other, either immediately or mediately, by the intervention of more or fewer perfect concords?

It is now likewiſe perfectly plain, that, by attending to the grave and acute marks, as well as to the ſharp and flat, compoſers have it in their power not only to form their melodies, but alſo their harmonies, as perfect as they chooſe, whether the ground of the muſic continue in the direct concordant relation to the principal key-note, or diverge from it. This will juſtify what was formerly ſaid, page 99, that the deviation of the tune of the fiddle may be effected without the ſmalleſt violation of the juſt quantity of any interval of tune.

To enable thoſe who chooſe to ſtudy the nature of this property of tune to know its whole extent, it is only neceſſary to obſerve, that it depends altogether upon the ſituation of the falſe intervals of the ſcale, the knowledge of which may be eaſily obtained by peruſing the figures 71, 72, 73, 74; and that the reſtoration of a diverging ſeries of tune, as well as the rectification of the falſe intervals of the Scale, is effected by means of the changeable ſeconds and ſevenths.

But it may ſtill be further obſerved, that, in paſſing from the fourth of a key major to the ſecond, and thence proceeding in the compoſition of a tune, there is no direct neceſſity to diverge at all from the immediate concordant relation of the key-note, nor in any reſpect to injure the perfection of the ſucceeding intervals; for the compoſer has it in his power to paſs directly from this grave ſecond to the ſixth of the key, by which the interval becomes true, whether taken aſcending or deſcending: for the ſixth greater ſucceeding this grave ſecond is a true interval, being the juſt chord of fourth if taken below the ſecond, or a juſt chord of fifth if taken above it: and thus the original pitch of tune is ſtill preſerved. And C, F, D`, A, C, may proceed by perfect intervals without diverging at all, notwithſtanding the introduction of the grave ſecond. And further, nothing forbids to paſs directly from D` to the key-note C, or to the third of the key E, by the tone leſſer or the tone greater, which are both true degrees of the natural diatonick ſcale.

Thus, in this as well as in the former caſe, the grave ſecond may be introduced, and the perfect relation of the tune of the key-note ſtill preſerved entire: and, in general, a little attention to the figures 71, 72, 73, 74, will give a clear idea of every method by which, in all caſes, the original pitch of tune may be allowed to diverge, and how it may be reſtored.

Whether it may be found proper to allow tune to diverge in this manner, and what may be the effects and limits, now that an inſtrument is found capable of definite and accurate tune, are inquiries which, with many others, ſeem to ariſe; but which cannot now be entered upon conſiſtently with the preſent plan.

Two more views ſhall only be added of the mutability of this ſecond of the major, or fourth of the minor mode; for it is the ſame degree in the ſcale, and the ſame too in reſpect of this property, by whichſoever of theſe names it may be diſtinguiſhed. Speaking of the keys natural, it may be called *D*; and inſtead of talking of the ſecond of the key major, or of the fourth of the key minor, we ſhall compare the relations of D and of D\` to the other degrees of tune belonging to the natural ſignature. It is hoped, that the neceſſity of illuſtrating ſuch a novelty in the doctrine of tune will plead an excuſe for dwelling ſo long upon it.

Both D and D\` ſtand in relation to C as true diatonick intervals; and I doubt not, that, in a more advanced inquiry, they may be ſhewn more emphatically to merit that epithet.

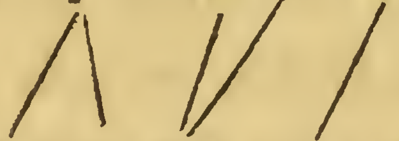
In a ſeries of notes in the diatonick order, comprehending both the major and minor modes, it will be found, that, by taking D and D' alternately, the whole intervals of the Scale will become perfect, either aſcending or deſcending. See fig. 75. The black lines join thoſe notes which form betwixt them perfect concordant intervals; and the pricked lines thoſe which are called *true diatonick intervals*, but hitherto not admitted to the title of *concord*.

This figure ſets the two D's upon ſuch a footing of equality in reſpect of their concordant relation to the other degrees of the Scale, and hence the changeable ſtate of D is ſo evidently marked, that it ſeems wonderful that ſuch a palpable law of tune ſhould have lurked ſo long in concealment; for, tracing the connection either forwards or backwards upon the figure, from the two D's through all the other degrees of the diatonick ſcale, by the connection pointed out by the black lines, they will appear, without exception, to ſtand alternately in true tune to the other degrees.

To thoſe who are acquainted with the principles of muſical compoſition, this law of the alternate relation of the grave and acute ſeconds will ſhew itſelf confirmed in all points of view. For when the ſecond of the key becomes the fundamental baſs-note, its harmonics being the fourth and the ſixth of the key, this fundamental note muſt be grave. The third of the key being the fundamental baſs-note, and the chord admitting a diſcordant ſeventh, which in this caſe is the ſecond of the key, this ſecond of the key muſt be acute; becauſe the harmonics of this fundamental are the fifth and ſeventh of the key. When the fourth of the key is the fundamental baſs-note, and the chord admits of an added diſcordant ſixth, which in this caſe is the ſecond of the key, the harmonics of this fundamental being the ſixth of the key, and the key-note, the ſecond of the key muſt be grave. When the fifth of the key becomes the fundamental baſs-note, the ſecond, being one of the harmonics, muſt be acute. Thus, in every point of view, the mutability of the ſecond of the key ſeems to be aſcertained paſt all doubt.

It is an object of no ſmall curioſity to obſerve, that inſtead of the reſolution of a ſingle diſcordant relation in the leading chord of a regular cadence, this view of the matter diſcovers a reſolution of two diſcordant relations made by the ſame movement.

The leading chord conſiſts of the 5th, 7th, 2d, 4th:



The reſolving chord, of the Key 5th, 8ve, 3d,

The lines drawn from the notes of the leading chord to thoſe of the reſolving chord, ſhew the movement of the parts. In the leading chord, the ſecond muſt be acute, becauſe it is a fifth to the fundamental; and conſequently both the intervals which the ſecond and the ſeventh make to the fourth of the key in the leading chord are falſe: and both are reſolved by the ſame movement; of the ſecond and ſeventh into the octave of the key-note, at the ſame time that the fourth moves into the third: and the effect muſt be exquiſitely delicate when produced by an inſtrument accurately tuned.

When, by repeated attention to the finer circumſtances and connections of the ſcale of muſic, one is enabled to gain a clear and extenſive view of its conſtitution, the whole preſents itſelf in the form of a moſt beautiful plexus, infinitely more pleaſing to the imagination than the moſt regular, but dull, though uniformly connected ſeries, which hitherto ſeems to have been the *deſideratum* in muſic, to ſupply the place of the broken and mutilated figure of the preſent eſtabliſhed ſyſtem. But however beautiful this view of the ſyſtem of tune juſt now preſented, (and indeed the very idea of it ſeems to whiſper muſic, agreeing with Mr Hutcheſon's definition of beauty, *variouſly regular*), it ſeems to fall greatly ſhort of what promiſes to ariſe from a more advanced inquiry into the ſubject.

The difficulties hitherto reviewed ſeem to have been real ones, and ſuch as have occurred to ingenuous minds ſincerely diſpoſed to ſearch after truth. But men, having once wandered from the right road, and finding themſelves bewildered and involved in inextricable difficulties, become impatient and averſe to acknowledge that theſe difficulties proceed from their own miſtake. This has produced aſſertions, that there is ſomething in the nature of tune which will not admit of rational explanation; a ſort of unaccountable variation, which, although great performers acknowledge they cannot explain, they yet pretend to practiſe: as if they would inſinuate, that the groſs touch of a finger can diſtinguiſh with greater nicety than the powers of intellect itſelf. But after conſidering what has been ſhewn to be the practice of the greateſt maſters of the art, and will be found to prevail in every compoſition for the violin, notwithſtanding the inſtrument is capable of true tune; perhaps it may not be judged unfair to ſuppoſe, that theſe maſters, knowing that the imperfections of other inſtruments are not imputeable to the fiddle, and alſo that there was no certain criterion by appeal to which they might be convicted of error; finding beſides, that ſometimes the place of the finger is varied in ſtriking a note, either miſled or otherwiſe, as chance would have it, by the tune of an open ſtring; they were willing to pay a compliment to the delicacy of their own performance, and, inſtead of attributing the variations to their own error, have imputed them to the nature of tune itſelf, and aſſerted, that there is a kind of variation in tune totally inexplicable, but which the touch of their *delicate* finger can exhibit *clearly* to the ear. How groſs ſuch reaſon! how exquiſite ſuch touch!

Such aſſertions are not eaſily combated, but the authority of maſters in any art is apt to bear ſuch a ſway, that it ſeems neceſſary to throw as clear a light upon this matter as it may admit.

Could it indeed be proved, that, in the execution of any piece, the performer ſtops every note in ſuch tune as to make the moſt perfectly agreeable melody of which the compoſition is capable, and at the end finds a variation in his tune from the original pitch of the key-note, different from what may be accounted for by the diverging properties of tune already explained; in this caſe, nothing would be left but to ſubmit and acknowledge the irrationality of the laws of tune, or rather to confeſs that its principles are not yet diſcovered.

In order to judge of a pretence to ſuch delicacy of execution as might diſcover a variation in tune different from that already explained, it is neceſſary to recollect what has been ſaid of the exquiſite nicety of touch that is required in the approach to true tune. This being compared with what has been the practice of the greateſt maſters, the vanity of ſuch a pretence will become ſufficiently apparent. And it would ſeem [redacted] probable, that when ſuch deviation happens, it muſt ariſe from the errors of the muſician, not from the nature of tune.

But does not the pretence of a muſician to perfect performance, in oppoſition to mathematical deduction, founded on the moſt deliberate and accurate experiments, amount to no leſs than ſetting up his own hand, nay the random touches of it, as the ſtandard of perfection? A very bold pretence ſurely, however bewitching the heights of excellence to which he may have attained.

If the compoſition proceed diverging from the original key, and it were poſſible that the performer could take every ſtep in juſt tune, there is no difficulty to account for the greateſt deviations upon the principles now diſcovered.

Nay, ſuppoſing the whole compoſition to be kept true to the key-note, but allowed to modulate into different keys, ſtill keeping true to the key-note laſt aſſumed, it is plain from the tune of the organ, that the difference of tune belonging to the ſame nominal note will often be no leſs than double comma. See the *Table of Comparative Degrees:* which ſhews ※C′ to ※C`, and D to D``, and E′ to E`, &c. all different from each other by double comma; while, by the ſame Table, the differences of the pitch of other of theſe notes, nominally the ſame, are ſo exceedingly minute as the ratio 32805 : 32768. It would be aſtoniſhing indeed, if theſe could all be ſtopped with ſtrict preciſion in rapid execution. It ſeems almoſt impoſſible in the ſimpleſt performance. But thoſe who pretend to ſuch execution as diſcovers the anomalous variation now treated of, actually profeſs to do more.

It ſeems therefore highly probable, that the pretence to ſuch a diſcovery is no more than an apology for ignorance; and the abſurd conſequence that muſt follow upon ſuch a ſuppoſition, ſufficiently evinces its futility.

Muſical ſound has already been defined

to be, that ſort of ſound which is ſmooth and even, in oppoſition to confuſed noiſe or continuous tune. The firſt part of this definition cannot be challenged. On the ſecond, reſpecting continuous tune, let it be conſidered, that when the finger is ſlid along a ſounding ſtring, the ſound indeed may be ſmooth, but the effect is ſhocking: and although this kind of tune may ſometimes be admitted into burleſque performance, it can never be conſidered as muſical.

The offence from continuous tune is ſtill the ſame, whether the riſe or fall be quick or ſlow: the ſmalleſt perceptible alteration of tune in that ſtyle is always diſagreeable. Can it then be ſuppoſed, that there is any thing agreeable in any degree of it ſo minute that it might eſcape the notice of ſenſe? The nature of the thing muſt be the ſame, whether it be quickly or ſlowly produced, or whether the alteration be great or ſmall, ſince, like the circumference of a circle, every part of it is ſimilar.

But there are only two poſſible means by which the pitch of tune can be varied in the act of performance; of which this continuous motion of tune is one: the other is a variation in the degrees of riſing and falling by diſtinct intervals; ſo that, in paſſing from one degree to another, and endeavouring to return by the ſame interval, we either exceed or fall ſhort of the original pitch.

It has been ſeen, how this may happen indirectly, by purſuing a certain order of harmonic intervals; and its laws and limits are now known: but if the anomalous variation now mentioned means any thing, it muſt mean more, That the attempt to aſcend and deſcend by the ſame courſe of intervals will generate a variation.

Let it then be ſuppoſed, that every particular deſcent exceeds the riſe made in attempting to return by the ſame interval, and that this is really known to produce the moſt tuneful melody; the more frequent, therefore, the riſes and falls of any piece of muſic, the lower it muſt fall in the general pitch of tune, if performed by ſuch able maſters as are capable to do it in perfection. But how will a concert go in this caſe? The firſt fiddle muſt gallop down-hill out of ſight before the reſt; and if the concert continue for any conſiderable time in this mode of proceeding, the baſs will at laſt become the acuteſt of all the parts; how much for the improvement of the muſic, is left to every one to determine. For it is clear from this hypotheſis, while the different parts have ſome more and ſome leſs diviſion of their notes, they cannot for a moment remain in agreement with each other. The ſame abſurd conſequence muſt follow, if the variation ſhall be ſaid to ariſe from the exceſs of aſcent; nor does it alter the caſe, ſhould the exceſs of aſcent or deſcent be attributed to all, or to any particular interval, or to the differences of the ſums of the exceſſes of both.

Therefore, while the agreement of different parts in concert, that are unequal in the number of their riſes and falls, is admitted, one cannot but reject the notion of ſuch an anomalous variation of tune.

To attribute the variation to continuous tune would offend againſt muſical ſentiment, much in the ſame manner as the denial of the truth of an axiom would ſhock a mathematician: And there is no other way by which the variation of tune can happen but by error in performance, which ſeems not ſo hard to be conceived.

The well-known fact, that vocal performers, when unſupported by an inſtrument, find their pitch fall towards the end of a performance, is alſo brought in ſupport of this ſuppoſed unaccountable variation in the nature of tune: becauſe it is alleged, that the voice being more immediately under the direction of the will of the performer, he is altogether at liberty to follow his own ſentiment; and if ſo, this depreſſion muſt be dictated by ſome natural feeling.

This points at ſomething more particular; and ſeems to confine the variation of tune always to one direction, tending conſtantly

ſtantly to flatten the original pitch. But a little reflection upon the nature of the diverging properties of the Scale will ſhew, that the variation's proceeding from that cauſe determines the change as readily to the ſide of acuteneſs as of gravity. For example, if the chaunt C, E, G, D, A′ C′, be ſung in perfect concordant intervals, either aſcending, or alternately aſcending and deſcending, the laſt C will be found to vary from the firſt pitch, and to be raiſed comma ſharper than the pitch of the firſt C or its octaves: therefore this variation of the voice muſt depend upon ſomething entirely different from the diverging properties of tune already explained.

The fact cannot be denied. And, before examining into its cauſe, it may be noticed, that there are many people poſſeſſed of exquiſite diſcernment in muſic, who have ſo little command of voice, as ſcarcely to be able to produce a few tuneful ſounds; nay, that the ſame perſon will ſing much better in tune at one time than at another: therefore it would ſeem, that we cannot reaſon from command of voice.

This variation, and the peculiar direction it takes, ſeems eaſy to be accounted for from a very different cauſe than the ſentiment or choice of the ſinger.

The power of preſerving an equality in the pitch of tune in ſinging, is allowed to be owing to the power of preſerving an equal degree of tenſion in the muſcles of the larynx; and the ſmalleſt relaxation occaſions a proportionable falling of the voice. As this tenſion requires a continual and equal exertion of the animal ſpirits to ſupport it, it would ſeem a much greater wonder to find that this exertion was equally preſerved through the whole of a performance, than to find that a ſmall relaxation did frequently happen, and by that means the voice ſhould imperceptibly ſlide from the firſt pitch of tune, even againſt the inclination of the performer.

Let the pitch be given from whence a ſong is to begin, and let the variation be carefully noticed at the end: the pitch being again given, let the ſong be repeated; and it will be wonderful indeed if the variation is found exactly the ſame as before. If it is not, it muſt be owing to error; and ſuch variation cannot be traced from any ſecret principle or property in the nature of tune.

It is well known, that if there be any conſiderable difference in the ſtate of the animal-ſpirits, the degree of variation will be remarkably altered; that is, it will be ſenſibly greater when the ſpirits of the performer are flat than when they are lively. This ſo clearly marks the dependence of this variation of tune upon the corporal habit of the ſinger, that we cannot have recourſe to any other cauſe.

CHAP. VII.

Of a new opinion concerning the connection between muſical ratios and thoſe of a circle.

IT ſeems neceſſary to examine a modern doctrine, which, although not yet publiſhed, has been communicated to many; and the reſpect juſtly due to the great ingenuity of the author will probably give it a degree of credit which may bias the judgment, and determine ſome to withhold their aſſent to the truth of the preceding diſcuſſions.

In this doctrine of Mr Harriſon, of which ſome general account is given in the Preface to Mr Smith's *Harmonics*, and of which I have heard ſome further accounts from the author himſelf, the ratios of tune are ſaid to be beſt diſcovered by conſidering the ratios exiſting among certain ſtraight lines drawn within a circle. One of the concluſions is, that we muſt abandon the diſtinction of the tone greater and the tone leſſer; and reduce the elements of muſic to tones of equal dimenſions, and ſemi-tones alſo equal to each other; each ſemi-tone being the juſt half of a tone. This concluſion, if juſt, would overturn all that has been ſaid in this Eſſay, and with it all that has been eſtabliſhed by the conſent of ages, and the moſt accurate experiments of the greateſt philoſophers, as well as of muſicians and muſical mathematicians, from the earlieſt dawn of Greek literature down to the preſent time. It muſt be acknowledged, that one good effect would follow: it would greatly facilitate the ſtudy of muſic, and render the truth of tune much eaſier to be attained than has hitherto been ſuppoſed. But, to balance this advantage, it would moſt fatally deprive us of that beautiful variety which the foregoing ſheets ſeem to diſcover, and which a more advanced inquiry into the nature of tune will greatly enlarge.

Modern philoſophers have exploded the ancient hypothetical mode of inquiry, and pay a ſtrict attention to the nature of the particular ſubject under conſideration. Whatever ſimilarity may appear among the general conditions of any two objects, yet if every quality diſcovered in the one be not equally found in the other, no reaſoning is permitted from the one to the other. If they are right, the author of this new doctrine m~~uſt~~ay be wrong. For ſurely our perception of the proportions of ſtraight lines drawn within a circle, is not very obviouſly ſimilar to our perception of the agreement of muſical ſound; nor does it appear prudent to rely upon an examination of the one for explanation of the other, while we have that other itſelf before us.

Moſt accurate experiments have been made upon bended cords; the matter, thickneſs, and tenſion of which have been made as equal as poſſible, and differing only in length. From theſe experiments, often repeated, it has been found, that two bended chords, whoſe lengths are to each other as 3 is to 4, being founded together, the ear perceives the concordant relation of chord of fourth. When the lengths are to each other as 2 to 3, it perceives the chord of fifth.

Let there be three bended chords, differing only in length, the longeſt divided into twelve equal parts, another in length equal to nine of theſe parts, and the laſt equal to eight: if the cord twelve be ſounded with the other cord eight, theſe two ſounds will produce the concordant relation of chord of fifth; becauſe 8 is to 12 as 2 is to 3. Again, if the cord nine is ſounded together with the cord twelve, the two will produce the chord of fourth; becauſe 9 is to 12 as 3 is to 4.

Mathematicians have ſhewn, that the number of vibrations performed in the ſame ſpace of time by two cords differing only in length, are in reciprocal proportion to the lengths; and the difference of the lengths of the two ſhorter cords being as 8 is to 9, the cord nine ſhall perform eight vibrations in the ſame time that the cord eight ſhall perform nine vibrations. Thus the difference of tune which gives the chord of fifth from that which gives the chord of fourth, is radically eſtabliſhed; and this difference is the tone greater.

It has likewiſe been found, that two bended cords, (*cæteris paribus*), whoſe lengths are as 3 to 5, being ſounded together, produce the chord of ſixth greater. Suppoſing, then, other three cords, differing only in length, and that their lengths are as 9, 10, 15: if the two cords 9 and 15 are ſounded together, the concord of ſixth greater will be perceived; for 9 is to 15 as 3 is to 5. Again, if the cords 10, 15, are ſounded, the chord of fifth will be perceived; becauſe 10 is to 15 as 2 is to 3. Therefore, according to what has been already ſaid, the difference between the degree of tune which gives the chord of fifth, and that which gives the chord of ſixth greater, is a ratio of 9 to 10; which is tone leſſer.

And the ratio of tune 15 : 16, called the *elementary ſemitone*, being the difference between the third and the fourth of the major mode, is eſtabliſhed by the following experiments.

The lengths of the bended cords which, when ſounded together, produce the chord of third greater, are as 4 to 5. The lengths of the cords which produce the chord of fourth are as 3 is to 4. Of three bended cords, whoſe lengths are as 15, 16, 20, if the two which are as 16 to 20 are ſounded together, the chord of third greater will be produced; becauſe 16 is to 20 as 4 to 5. If the other bended cord 15 is ſounded with the cord 20, the chord of fourth will be produced; becauſe 15 is to 20 as 3 to 4. The ratio, therefore, of the interval between the greater third and the fourth of the ſcale, is as 15 to 16: and the experiments which prove that theſe ratios take place in the other parts of the ſcale, are pointed out by every writer upon the theory of muſical ſound.

Whoever doubts theſe experiments, may eaſily make trial; and if they are found to hold true, he muſt either acknowledge the true quantities of the elements of tune, or deny the evidence of the firſt principles of arithmetic.

I have heard a ſix-ſtringed viol, fretted according to the rules of this new doctrine, played upon by a moſt unexceptionable performer, (Mr Harriſon himſelf), and found no difficulty to point out its errors, to the conviction of the performer; whoſe only defence was, that it was impoſſible to put an inſtrument in better tune.

Honour is due to the ingenuity of Mr Harriſon: and although his ſyſtem muſt be condemned, his ſpirit is to be ranked with that of the conqueror of the world; who, becauſe he could not untie the Gordian knot, cut it in pieces. But the knots of ſcience are compoſed of that adamantine twine which, if they cannot be looſed, refuſes to be cut.

CONCLUSION.

Limitation of the preſent plan of inquiry.

However certain it appears, that, by fortunately ſtumbling into the right track, ſome of the true principles of muſic have been diſcloſed, the application of which to practice muſt highly improve the art; and, [redacted] that, if the train were purſued, it would lead ſtill to further and greater diſcoveries; yet it is propoſed to reſt here at preſent.

For although Dame Nature ſeems not over coy when we get the cue of her addreſs; yet ſhe keeps fully up to her *etiquette*, and is only to be won by punctilious attention: an attention, which the preſent fate of ſcientific diſcoveries ſeldom juſtifies the author for having beſtowed.

Whether the inquiry ſhall be reſumed, is uncertain: but, before dropping the curtain, it is to be remarked, that the ſubject ſeems far from being exhauſted. It has been purſued conſiderably beyond the preſent limits; and ſeems to promiſe a large acquiſition of materials for varying and exalting the powers of muſical expreſſion, both in melodies and harmonies, naturally ſuggeſted from theory, and confirmed by experiment.

A more advanced inquiry would ſhow, that theſe acquiſitions, which improve the effects, will not add to the difficulties of the practice of muſic, upon inſtruments properly conſtructed; nor does any thing occur from reflection that ſeems to obſtruct the reformation of our preſent inſtruments, the trumpet kind only excepted.

It may likewiſe be noticed, that ſmall progreſs was made in this Eſſay before it was diſcovered, that the ſubject leads to a greater length than the mere ſolution of the foregoing difficulties. An inquiry at large ſeemed a taſk too heavy to be undertaken at once. The preſent plan was therefore limited to the views that have hitherto been given by the moſt approved theoriſts. But, upon more attentive examination, ſome of the received ideas concerning the properties of the ſcale of muſic appear erroneous. Theſe could not be made ſubjects of diſcuſſion in this Eſſay, without introducing matter foreign to the preſent plan; nor ſhould they be altogether paſſed over in ſilence. It ſeems ſufficient at preſent to ſay, that the immediate object of inquiry did not require their correction.

APPENDIX.

HINTS *for Practical* IMPROVEMENTS.

IN the preceding Eſſay, there has only been produced one ſingle plan for the formation and management of the ſtops of the organ, in modulating from one key to another. The tune peculiar to each of the twenty-four keys of muſic being ſeparated from the reſt, and a method pointed out whereby any of the keys may be introduced or thrown off at pleaſure, a diſtinct view of the ſubject is thereby preſerved. But various means may be deviſed for improving upon this plan, and rendering the command of every pitch of tune, ſeparately, univerſal over the whole inſtrument. One of theſe may be as follows:

Let a cylinder be placed upon the organ, that may act upon the degrees after the manner of the barrel of a muſical clock; not for performing the muſic, but for opening and ſhutting any of the pipes aſſigned to each finger-key, as occaſion may require. When a change of any of the degrees of tune becomes neceſſary, the cylinder may be turned by preſſing the foot upon the ſpoke of a wheel, conveniently ſituated, and contrived to communicate its motion to the cylinder. The pins which act upon the hammers of a muſical clock are ſtuck into the barrel; in place of this, the ſurface of the cylinder of the organ muſt be provided with grooves fitted to receive ſliding pieces, each of which ſliding-pieces, having a pin ſtuck into it, may be drawn readily to the point, where it will act upon any particular degree of tune required. Thus the cylinder may be previouſly prepared for the performance of any piece of muſic.

An index of tune ſhould be marked upon every muſical compoſition, for directing the preparation of the cylinder; and correſponding marks ſhould likewiſe be placed over or under the muſical notes, where a change is required, for directing the performer when the cylinder ought to be turned.

The index may be made by marking in the firſt place the letters, with their proper ſigns, which repreſent the notes with which the tune begins: and when, in the progreſs of the muſic, any note appears, requiring an alteration from the original pitch, a ſmall aſteriſk may be placed under it, to ſhow that the cylinder ſhould then be turned; and another aſteriſk being put in the index, the new degree of tune ſhould be marked immediately after it: and ſo on to the end of the compoſition.

This is exemplified in St David's tune. See Scale N° 78. This tune being written in ſcore, the aſteriſks ſhewing the changes of pitch are marked below the baſs only, even when the change of pitch happens in one or other of the upper parts. The firſt aſteriſk ſhows, that G of the baſs is changed to G\`: The ſecond ſhows, that the ſame note is to be reſtored to the former pitch: The third, that it muſt again be made G\` in the treble: And the fourth aſteriſk ſhows, that it is finally to be reſtored to G° in the tenor or church part.

Upon every account, this laſt method ſeems greatly preferable to the other; ſince by it the inſtrument may be qualified to introduce any particular combination of degrees, and to change and reſtore any ſingle note at pleaſure.

It would be advantageous to have two wheels fitted to the ſame axis, one for each foot, to ſerve in caſe of a quick ſucceſſion of changes of degrees.

It is eaſy to foreſee, that the number of tones which this ſyſtem of tune requires to complete the octave, will probably be conſidered as an objection by thoſe who are diſpoſed to find difficulties; and indeed may ſtartle others who, ſincerely wiſhing to promote every improvement, are heartily inclined to judge with candour.

But nature impoſes no ſuch load; tho' men often, through their own miſtake, oppreſs themſelves with intolerable burdens. The vaſt apparatus of muſical keys and ſignatures, with which muſicians have been long encumbered, is plainly a burden of this kind, and may be ſafely dropped without any loſs to the art. Nay, it is certain, that it muſt one day appear, that the diſcharging the ſyſtem from ſuch lumber will make way for the introduction of the moſt valuable acceſſions. The preſent plan of inquiry does not admit of entering into an inveſtigation at large; though a general inquiry ſhall be attempted, upon the received principles of tune, into the merit of the preſent ſyſtem of twenty-four keys, and afterwards into what may truly be ſtyled a *ſyſtem of tune.*

But if it is required that an inſtrument ſhould be furniſhed with the degrees of tune fit for twelve ſignatures, and if it be true that no fewer than thoſe already mentioned will afford true tune, it is here the ſtation ought to be fixed from whence we may take the ſubject under our eye: and looking down to the hemitonick ſyſtem of twelve degrees of tune, where each ſtands in place of not leſs than three, but oftener of four different pitches, very many of them differing by no leſs than double comma; we ſhall be apt to wonder how it is poſſible that ſuch a ſyſtem could at all produce muſic to which we could liſten. Again, the ſtation being changed, and experiencing that delight which even this hemitonick tune is able to give, when we ſhall look up to the other, how does it raiſe our ideas of the effects of muſic, when thus refined, and produced in all its purity? The very number of tones requiſite demonſtrating the groſſneſs of the one and the purity of the other, inſtead of proving a diſcouragement, becomes the ſharpeſt ſpur to quicken induſtry.

I am but little acquainted with the internal ſtructure of organs; but there is reaſon to believe, that very many of them, in the preſent imperfect form, are furniſhed with more than triple the number of pipes to each finger-key which this refined ſyſtem of tune requires: and this, too, for the ſole purpoſe of obtaining variety of noiſe; for, pure and diſtinct tone being the true *materia muſica*, all other differences of ſound in contradiſtinction to this deſerve no better epithet.

If the common organ often contains ſuch a number of pipes, it is plain that an organ may be conſtructed upon the preſent plan, which ſhall have no more pipes, and yet be fit to give three tones in uniſon to every degree of its tune; and if it has been thought worth while to labour for variety of ſound, true tune is certainly a nobler object to excite ingenuity.

It may likewiſe be obſerved, that as every additional ſignature introduces ſome additional pitches of tune into the ſyſtem; ſo if ſome of the more unuſual ſignatures are ſpared, which may well be done, the taſk would be conſiderably leſſened.

In ſhort, if this view of the relations and progreſs of tune ſhall be approved, it becomes neceſſary to ſubmit to ſome additional labour; for nature will not bear to be forced from her place: otherwiſe we muſt fold our hands, with the ſluggard, and ſay, *There is a lion in the way.* Perhaps the following inquiry into what may be properly called *the ſyſtem of tuneful ſounds*, may ſerve to alleviate the taſk.

Previous to this inquiry, we may remind the reader, that it is upon experiments made upon bended cords, after the manner mentioned in pages 245, 246, 247, 248, that the true tuneful relation of muſical ſound has been diſcovered; and that the degrees of the diatonick ſcale, as they have hitherto been reckoned, whether in the major or minor mode, are in number ſeven, and the octave. But the inequality of the intervals among theſe degrees, the impoſſibility of a common diviſor, and the other circumſtances already ſtated relative to the ſuppoſed imperfections of the ſcale, have hitherto ſhewed it, in a variety of points of view, to be impracticable in its perfect form. Of the three natural elements two were found to be nearly ly equal, and the third not much exceeding the half of either. Neceſſity, therefore, compelled muſicians to ſuppoſe an equality of the natural tones, and alſo that ſemi-tone was the half of the undiſtinguiſhed tone.

It being likewiſe found, that there are five tones and two ſemi-tones in the octave; by dividing theſe five into halves, and adding two half-tones repreſenting the two elementary ſemi-tones, the octave thus came to be repreſented by thirteen notes, comprehending twelve intervals, equal, or ſuppoſed to be equal, to each other. The purpoſe of this diviſion was to enable the muſician to change his key at pleaſure, and ſtill have it in his power to proceed by the ſame proportionate degrees to the new key-note as he did to the firſt key-note. This ſuggeſted the invention of ſharp and flat marks for the ſignatures, to direct to the manner how this groſs ſyſtem of tune ſhould proceed from each of theſe half-tones; and there being twelve of theſe half-tones in the octave, there were required twelve ſignatures for directing to the degrees of tune related to each of them conſidered as a key-note.

Hence muſicians acknowledge twelve ſignatures, and no more; each of which containing a major and a minor mode, as has been explained, they amount in all to twenty-four keys of muſic; which continues to be held as the ſyſtem of muſic to this day.

As it has always proved dangerous to combat errors which have gained an eſtabliſhment from length of time, it ſeemed beſt to adopt this ſyſtem, and purſue it through all its mazes: and accordingly there has been given a complete regulation of all theſe twenty-four keys.

Although it plainly appears, that this progreſs might be continued *ad infinitum*, and therefore that the number of ſignatures and of keys might be increaſed indefinitely; yet, ſtill to adhere to the received opinion, the ſyſtem of twenty-four keys has been allowed to ſet bounds to this plan. But, from what has yet been diſcovered of the nature of melody or harmony, theſe twenty-four keys ſeem much more than ſufficient to yield all the variety that compoſers have hitherto, but very imperfectly, aimed at.

Before venturing to inquire into what may be eſteemed a ſyſtem of tune, to remove eſtabliſhed prejudices, and that the reader may be prepared to think liberally, he may deliberate with attention upon what has been ſaid, That the hemitonick ſcale is a falſe diviſion, and has only been adopted as a ſuccedaneum, to ſupply the want of a diviſion founded upon the true principles of nature: That this true diviſion being now diſcovered, ſhows the progreſs of tune to be really infinite; and therefore that this limitation to twenty-four keys, which is founded on error, has no title to be conſidered as a ſyſtem preferably to any other limitation, at leaſt for ought yet known. Therefore we may hold ourſelves at liberty to inquire with freedom into the number or combination of keys, ſignatures, or *notes*, which ought to be admitted as a ſyſtem, and which will give the whole variety that tuneful ſound can afford. If this could be found, there would be no reaſon to doubt of its title to be received as the true ſyſtem of muſical ſounds; all beyond which would only be a repetition of the ſame circumſtances, and therefore the ſame in real value, however differently modified for an unmeaning affectation of variety.

It has been formerly hinted, that there ſtill are concordant intervals not yet defined or diſcovered by muſicians. It is neceſſary therefore to notice here, that the following inquiry is confined to the limits of the plan of this Eſſay; that is, to the tuneful intervals already admitted by theoriſts, and to the doctrines taught concerning them. What follows will therefore give but a very imperfect view of the ſyſtem of tune, but may prove an excellent preparation to an inquiry at large.

Whoever may enter upon ſuch an inquiry with judgment, will probably find, that inſtead of extending the limits of the following idea of a ſyſtem, by the addition of new keys and ſignatures, there may be reaſon to ſtrike into the oppoſite track: and if experiment be admitted as a guide, means will not be found wanting to enrich the ſyſtem with a beautiful variety of additional members, while the general idea becomes more ſimple, and the whole perhaps better ſuited to practice.

But if the right track be not entered upon and purſued under favourable circumſtances, ages may paſs before much improvement is made. What follows may prove the means of introducing a high practical improvement in the mean time, and of leading forward to better.

Recollecting the order of the keys, page 38, in modulating from one key to another, it is generally ſuppoſed to be diſagreeable, (notwithſtanding that ſome compoſers have actually affected to introduce ſuch paſſages), if, paſſing over the immediate preceding or ſucceeding ſignature to the preſent principal key, a tranſition ſhould be directly made to any of thoſe keys which belong to a ſignature at a greater diſtance from it. For example: If the given principal key be either the major or the minor of the natural ſignature, a compoſer may agreeably and properly change the key, either for the other key belonging to the ſame ſignature, or into one of the keys belonging to the ſignature with one ſharp, or with one flat. But ſhould he attempt to paſs directly from either of the keys of the natural ſignature to one of thoſe belonging to a ſignature with two or more ſharps or flats; ſuch a change is generally held to be unnatural, from the diſagreement of the tune of the given key with that of the newly introduced key. If, then, the principal key cannot be agreeably changed for any other which belongs not to the tune of the ſame ſignature, or to the tune of the ſignatures immediately preceding or ſucceeding the ſignature of the given key, and if all the ſignatures ſucceed each other in their order in perfect uniform relation, there cannot poſſibly exiſt any difference of circumſtances in paſſing thro' all the ſignatures in their order, than may be found in modulating from a given ſignature to the preceding one by one direction, and thence returning again and paſſing to the ſucceeding one in a contrary direction. Therefore three ſignatures, comprehending three keys major and three minor, muſt yield all the variety that the diatonick ſcale is capable of affording, and ſeem better entitled to be called *the ſyſtem* than any other limitation whatever.

It has been already ſhown, that in a ſeries of muſical keys, in which the ſeveral pitches of tune are all truly adjuſted, if a change be made from one key major to the next in order of ſucceſſion, two alterations muſt be made in the pitch of the notes. If the change be made by addition of a ſharp to the given ſignature, theſe alterations fall upon the fourth and the ſixth of the given key, which ſtand in the places of the ſeventh and the ſecond of the new key: that is, if the natural key major C is given, and from thence it is required to make a tranſition to the key major G with one ſharp, the note A, which is the ſixth of the given key, muſt be raiſed comma; and the note F, which is the fourth of the ſame key, muſt be raiſed limma major. Again, if it be required to go directly from the ſame given key into the key major D with two ſharps, the requiſite alterations fall upon the notes A and E, which muſt be raiſed comma; and upon F and C, which muſt be raiſed limma major. But if a change be required to be made from the ſame given key into the key major A′ with three ſharps, the notes to be altered from the original pitch are A, E, and B, to be raiſed comma; and F, C, and G, to be raiſed limma major. So that the note D, which is the ſecond of the given key, would alone remain in its original pitch. This ſecond being a diſcord to its proper key-note, whilſt the key-note itſelf, with every other member of the key, have undergone an alteration of their pitch by the diſtance of a diſcordant interval; the idea of all concordant relation to the principal key muſt be deſtroyed, the tranſition muſt be diſagreeable, and the connection totally loſt. Hence it ſeems to follow, that every ſuch change of key muſt be unnatural, however the affectation of novelty may have induced ſome compoſers to introduce ſuch tranſitions into their compoſitions: nay, in changing from the key major C natural to the key major D with two ſharps, the given key-note, the third of the given key, the fourth and ſixth of it, having all undergone alterations; the above opinion, that ſuch a change muſt be unnatural and diſagreeable, ſeems to be ſupported. The tranſition frequently made from one of the adjuncts of the principal key directly to the other, will appear to be no exception to this rule. For the ſlighteſt reflection will make it evident, that it is alone owing to the intimate connection and dependence of theſe adjuncts upon the principal key that ſuch a change can be tolerated, and not at all to the relation which theſe keys independently hold to each other; for it is well known, that while either of theſe adjuncts is introduced, and continues as ſuch, the idea of its dependence upon the principal key is perfectly preſerved.

This view of the ſubject ſeems to lead to a ſatisfactory deciſion upon the merit of queſtions which have ariſen concerning the propriety of many paſſages in compoſition, introduced by ſome compoſers, and condemned by others as unnatural: and it will lead to diſtinct views of the moſt delicate connections, not only of the adjuncts and ſubſtitute of any particular key, but alſo of the ſubordinate adjuncts and ſubſtitutes, and of the conduct of their particular harmonies.

As the changes of key in flat harmony will be found to be under the ſame predicament with thoſe already noticed reſpecting ſharp harmony, reaſon ſeems to ſupport the aſſertion of thoſe who, upon the teſtimony of their ſenſes alone, tho' imperfectly ſupplied with information from falſe performance, have condemned tranſitions to diſtant keys of both kinds:

and (ſtill confining our notions to the already diſcovered principles of tune) it ſeems reaſonable to conclude, that, to the perfect expreſſion of any chaſte compoſition, no other degrees of tune are required than thoſe comprehended within the limits of three ſignatures, containing three major and three minor keys. The ancients knew theſe, and no more; and the beſt modern writers ſeem to acknowledge no more.

All the others which our preſent ſyſtem affords plainly appear to proceed from the falſe diviſion of the ſcale into twelve indefinite half-notes. Indefinite they may well be called, ſince theſe twelve degrees of tune are all the furniture of a ſyſtem of no leſs than twenty-four keys of muſic; whereas it can now be ſhown, that, to complete this ſyſtem of ſix keys only, not leſs than eighteen degrees are required.

To ſhow the impropriety of any change of key which would require a ſyſtem of tune extended to more than the degrees contained in three contiguous ſignatures,

tures, in ſtill another point of view: Let the key major C natural be the principal key given; if from it the modulation is carried into the key major D with two ſharps, the leading chord to this key D conſiſts of theſe notes, G, A′, *C, E′. Every note of this chord but G is altered from the original pitch: and G, being a diſcord, ſeems to loſe too much of its character as a member of the principal key in this ſituation to afford a ſufficient ſupport to the connection of tune; but eſpecially when it comes to be reſolved into the chord of D, the fundamental of which is itſelf a diſcord to the principal key-note, and both its harmonics, *F and A′, are altered notes.

Nay, in the leading chord D, *F, A′, C, which is the chord that uſhers in the adjunct fifth of the given principal key, the principal key-note C itſelf ſtands amongſt the harmonics of D as a diſcord; and the other two harmonics, *F and A′, are both removed from their original pitch of tune. In this chord, therefore, the connection of tune with the principal key ſeems to reſt upon a moſt precarious footing[*]; the note C, as principal key-note, being as it were juſtled out of its character by every note of the chord, and the idea of that character but feebly retained by the preſence of C itſelf, obſcured, and almoſt overwhelmed by the tendency of the other pitches of tune. Its ſituation here reſembles that of a ſick perſon in extremity, where, the ſoul being in a hovering ſtate, as if doubtful about its departure, the ſmalleſt circumſtance added to either ſcale is ſufficient to caſt the balance between life and death. In this caſe, the only remedy ſeems to be the reſolution of the diſcord in the chord of fifth of the principal key, which conſiſts of notes all in the original pitch, G, B, D; while any thing of a different tendency would diſſolve the connection with the tune of the principal key. The chord of D with its ſeventh, containing no degrees of tune

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[*] The balance hangs very even; C and D remaining in the original pitch, ※F and A′ altered.

but thoſe natural to the key of G with one ſharp, ought not to be conſidered as belonging to the key major with two ſharps, but only as the leading chord of the fundamental fifth of the key G, introducing that key as adjunct to the principal key.

The reader will readily perceive, that the ſame law muſt take place in modulations into the minor keys belonging to this ſyſtem: but the further application of this doctrine ſhall be left for his own amuſement.

All this reaſoning, however juſt it may appear from the received opinions concerning the properties of tune, and however uſeful it may be for diſcovering a practical limitation, muſt yet be left under the correction of future inquiry. All here meant is to ſhow, that the true expreſſion of what has been hitherto aimed at in compoſition, may be attained from a much leſs expenſive apparatus than might be ſuppoſed.

Thus, it would appear, that any

note being given as a principal key-note, whether in the major or minor mode, a compoſer may from it, with all propriety, modulate into five different new keys, and no more; which keys are comprehended in the ſignature to which the principal key belongs, and the ſignatures which immediately precede and ſucceed it; and that the limits of modulation can be extended no further, without becoming (in the words of the ingenious Mr Malcolm) "unnatural and inconſiſtent."

From the views hitherto taken, it would appear that theſe limits need not be extended; becauſe within them lies all the variety that the diatonick ſcale can afford. For the ſame reaſon, too, it would ſeem, that all true tuneful compoſition may be executed upon an organ conſtructed with three ſignatures only, through all its modulations. For, by tranſpoſition, any piece of muſic, wherever its principal key is placed, may be removed to any other key of the ſame mode; and if its modulations or changes of keys extend no further than theſe limits, an organ, whoſe tune comprehends no more than the degrees proper to three connected ſignatures, muſt be fit for executing all ſuch compoſition in true tune.

By comparing the degrees marked in the Scale N° 76. called *Arrangement of three contiguous ſignatures*, with the degrees of tune in the Scales of particular arrangement N° 47, 48, 49, 50, 61, 62, it will be found, that, to conſtitute the tune of one ſignature in perfect diatonick intervals, eleven different degrees are required; the ſeven ordinary notes of the key major, the grave ſecond and flat ſeventh, and the ſharp ſixth and ſeventh of the key minor. And in forming the next ſignature in order, there is required an addition of four degrees. If to theſe there be ſtill added what is needful to complete the tune of a third ſignature, alſo in order, there will be only three additional degrees wanted beſides thoſe which have been already prepared for the other two. And every new ſignature required to be afterwards added to the tune of the inſtrument, will demand three new degrees. So that an inſtrument furniſhed with three full ſignatures in perfect tune will require no more than eighteen different degrees of tune to each octave; or, including the key-note repeated in octave, the number of notes required will be in all nineteen: and theſe will be fit to afford a modulation through ſix different keys, all in perfect tune.

This ſeems to point out the way to obtain the inſtrument in true tune in its moſt ſimple form; and alſo gives latitude for extending it indefinitely: for twenty-one degrees of tune will give eight keys, twenty-four, ten keys, and ſo on; adding three degrees for each additional ſignature, each ſignature comprehending a major and a minor key, till the inſtrument become as comprehenſive as may be required.

Two ſtaves only of muſic-lines are allotted to the Scale N° 76.; becauſe there are not more than two degrees of tune belonging to any finger-key; and conſequently no more than two tranſverſe rows of pipes are required for theſe different degrees upon the organ. The degrees which are ſingle, and the graver ones of the double degrees, are placed in one continued row upon the loweſt ſtaff; and the more acute degrees which remain, upon the upper ſtaff; to ſhew the manner of placing the tune upon the inſtrument.

Upon examining this laſt ſcale, it will be found, that every place of the hemitonick ſcale of the common organ is ſupplied at leaſt with one degree of tune, and ſome with two; the places which have two degrees being equal in number to thoſe which have but one. Hence it might be hoped, that this ſyſtem will give an additional proof of its authenticity, ſince it ſupplies the chroma completely in every degree, and even affords variety for choice.

Neither in this are our hopes altogether diſappointed; for, upon examination, it will be found, that the degrees in this ſimple ſyſtem afford materials ſufficient to furniſh the moſt approven chromatic paſſages with a fundamental baſs and its accompaniments, all in juſt harmony to each other. But if theſe paſſages are reſtricted to the degrees marked in the Scale N° 76, and the fundamental notes of the harmony alone uſed for the baſs, it muſt be acknowledged, that there is a neceſſity for admitting ſome quantities among the ſucceſſive intervals of the fundamental progreſſion, which have not hitherto been examined or defined: and although they ſeem well entitled to a place among tuneful intervals, yet they muſt be rejected at preſent, as inconſiſtent with the propoſed plan of inquiry: therefore ſome new degrees are inſerted as neceſſary to furniſh out the chromatick paſſages in full tune, according to the received doctrines.

Theſe new degrees are added to the Scale N° 76. upon a ſtaff of muſic-lines put below. How far theſe additional degrees, or others which may be required for ſimilar occaſions, may be found ſtrictly neceſſary to furniſh out the ſyſtem, ſhall be left as matter of ſpeculation to the curious. An appeal may be ſafely made to the judgment of the ear, attending to an inſtrument accurately tuned. But they are ſtrictly neceſſary to the preſent purpoſe; which is to ſhow, that there is no natural impoſſibility of purſuing tune in any direction, by intervals which have already been univerſally acknowledged to be juſt. Some of the approven chromatick paſſages are therefore added, (ſee N° 77.), regulated by intervals acknowledged to be juſt, and yielding to the diverging properties of tune where it cannot otherwiſe be effected. The examination of theſe is left to ſuch as are verſant in the principles of muſical compoſition and thorough-baſs; to whom, a little attention to what has been ſaid will render it eaſy: but without a formal diſcuſſion of that ſubject, it is impoſſible to make it at all intelligible to others.

The diverging properties of tune have been already explained: and it has been ſhown, that it is in the power of the compoſer to yield to, or to check the divergency, at pleaſure; or to reſtore the original pitch, after it has been permitted to diverge to any diſtance, and in any direction. But in order to this, he muſt be perfectly acquainted with the nature of the diverging properties; and compoſers being hitherto in the dark about that matter, no wonder if our muſical compoſitions ſhall often be found, upon examination, to run to extravagant diſtances from the original pitch.

From the ſmall experience I have had in examining compoſition, it would ſeem, that the tendency of particular paſſages to diverge ariſes chiefly from an improper diſtribution of the harmonics among the parts; and that it may generally be checked by altering the ſituation of particular notes from one of the parts to another. But if it ſhall be required that an inſtrument be furniſhed with degrees to ſupply the diverging ſeries, it is eaſy to add them; and, from what has been already ſaid, the manner of tuning theſe degrees muſt be ſufficiently obvious.

There are many obſervations of much curioſity which might be made from attending to the circumſtances of this ſyſtem of tune; but moſt of them cannot be rendered intelligible without tranſgreſſing the bounds of the preſent plan. One, however, may be mentioned. In regulating compoſition by this ſimple ſyſtem, frequent opportunities occur of admitting ſome very ſmall intervals into the progreſs of melodies, even down to the comma; all accompanied by regular fundamental progreſſions, with harmonies in full tune. Hence we are led to pay no ſmall reſpect to the accounts delivered by the ancients of their *enharmonic* ſyſtem of muſic.

Before concluding, it is incumbent on the author to mention an ingenious objection that has been ſtarted againſt the uſe of the reformed inſtrument in concert with others leſs perfect; it being ſaid, that this would occaſion a contraſt, and produce ſtill greater diſcordance among the parts.

In order to give the plaineſt anſwer to this objection, it is neceſſary, in the firſt place, to obſerve, that the degree of merit of every performer depends upon the degree of approach he is able to make towards true tune. Every tolerable performer, upon almoſt every inſtrument, has more or leſs command over the pitch of almoſt every note of his inſtrument; and having his ear attracted by what is excellent, he is irreſiſtibly drawn to approach it. Hence every band of muſicians is always known to be improven by the acceſſion of a better performer. But vocal performers, and performers upon all inſtruments of the violin kind, can make this approach without limitation. Therefore it would ſeem reaſonable to think, that the effect of the reformed inſtrument muſt be the improvement of the whole. For although it is plain, that an untuneful inſtrument may greatly mar the effect of others more tuneful; the contrary poſition, that a tuneful inſtrument would be of diſadvantage to others leſs perfect, is by no means evident.

But, to illuſtrate this point more clearly: Let the ſucceſſion of tune, in every part of a fine compoſition, be repreſented by a beautifully waving line, (not that a ſtraight one is improper), ſuch as has of late been termed the *line of beauty* by Hogarth. The reader will remember, that it has been ſhown, that the errors of muſicians fall ſometimes on the ſide of acuteneſs, and ſometimes on that of gravity: ſo that theſe errors, and the ſeries of tune which contains them, may be juſtly repreſented by crooked lines of deformity; deviating from the tuneful line. Therefore, whilſt one ſet of performers in concert are on one ſide of the tuneful line, and the reſt on the other, beſides the faults of each conſidered ſeparately, theſe frequent oppoſitions muſt double the errors. But if the tuneful line be interpoſed between them, beſides its conſtant effect to attract the others towards itſelf, it is at no time ſo diſtant from either of the ſides as they are often from each other.

It is not foreign to the preſent point to obſerve further, that perſons poſſeſſed of the fineſt natural ear for muſic, when firſt entering a full concert, inſtead of reliſhing it, rather find themſelves embarraſſed with what to them appears a confuſion of different ſounds, which they are incapable of uniting ſo as to perceive the combined effect. And perhaps it is not till after great experience that any one attains a tolerably complete idea of the joint effect of a full concert. In the mean while, it is univerſally admitted, that what is naturally beautiful never fails of producing an agreeable effect, when preſented to the mind unbiaſſed by prejudice; and, on the other hand, it is well known, that by the repeated uſe of things naturally diſpleaſing, a reliſh for them may be acquired by habit. Shall it then be ſuppoſed, that the delight we feel from harmony ariſes not from what is naturally beautiful, but from what is naturally diſpleaſing? Such a ſuppoſition ſeems too abſurd to be admitted.

To what, then, may this embarraſſment, upon firſt entering a full concert, be aſcribed? Unqueſtionably to the imperfect agreement of the parts; owing to the defects of inſtruments, and the erroneous practice of performers. This, however, is not ſo conſiderable, but that, by time and experience, the mind being led to the idea of what ought to be produced, learns in ſome meaſure to ſupply the defects, by an effort of the imagination; whereas, if theſe errors had not exiſted, the beauties of harmony could not have failed to ſtrike moſt powerfully, upon the very firſt hearing.

That this muſt be the caſe, ſeems clear from the experiments upon the tune of the fiddle, mentioned in the Firſt Part of this Eſſay; eſpecially if made with a wire. See page 133.

Judging when an approach is made within much leſs than half of comma to perfect concord, let the effect be noticed, and then make the chord as perfect as poſſible, the tranſcendency of the perfect interval will appear ſo ſtriking, as not to leave a doubt that the beauties of harmony could remain concealed from the moſt inexperienced ear, if produced in ſuch a degree of purity. From what has been already ſhown concerning the tune of our beſt inſtruments, and the practice of the greateſt maſters, there is reaſon to apprehend, that we never, in any ſingle inſtance, hear a full combination of muſical ſounds in concert that is not tainted with much greater blemiſhes. Nay, if the chords are finely adjuſted, and drawn from a good fiddle, eſpecially the chords of third and ſixth, and more particularly the minor third and ſixth, a perſon who has been much accuſtomed to the harpſichord will readily acknowledge, that his inſtrument, when in the beſt tune, never afforded diſtinct expreſſion of theſe chords, although that inſtrument is a ſtandard one in all our muſical performances.

It ſeems clear, that all our capital inſtruments are very ſuſceptible of reformation, with little encroachment upon the ſimplicity of their preſent conſtruction; nay, that all the varieties of tune required from each finger-key of the organ, in its moſt extenſive form, may be commodiouſly produced from one ſingle pipe placed to each finger-key. And it is not to be doubted, but that ingenious men may be excited by proper encouragement, in ſome future period, to exert their abilities for reforming the preſent, or contriving new inſtruments, agreeable to natural and true tune, now that it is preſumed an opening has been made towards the knowledge of its laws.

But it is very queſtionable, whether the ears of the preſent generation will ever be gratified with the effect. The world, not unwiſely, jealous of pretences to diſcovery, examines with caution, and ſlowly yields aſſent. It is therefore very uncertain whether it would be prudent for any one now living to riſk his labour with a view to reap the reward. The apprehenſion of this muſt naturally damp the ardor of the ingenious; eſpecially if they reflect on the late deciſion upon literary property, ſet up againſt the exertions of ingenuity in general.

From a review of the general ſubject of this work, reflections of moment might be added, were they not foreign to its deſign. The danger of precipitate judgment might be remarked. Many things have appeared, to philoſophers, contradictory in ſcience and in nature. Criticiſms of various ſeverity have been made. The wiſdom even of Providence, in its wider adminiſtrations of the world, from circumſtances apparently unaccountable, has been arraigned or altogether denied. There is no ſubject more fit to exemplify the raſhneſs of ſuch philoſophy than the preſent; becauſe there is no ſubject which has been conſidered, by men of the greateſt talents in all ages, to betray ſuch inconſiſtency, as the laws of tune. No demonſtrations have been held more concluſive than thoſe which prove, that utter and complicated impoſſibilities forbid the reconcilement of the principles of muſic: And yet, after the ſpring has been fortunately touched, how ſpontaneouſly do they unfold themſelves! how ſimply and rationally beautiful!

FINIS.

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1781.

CORRECTIONS.

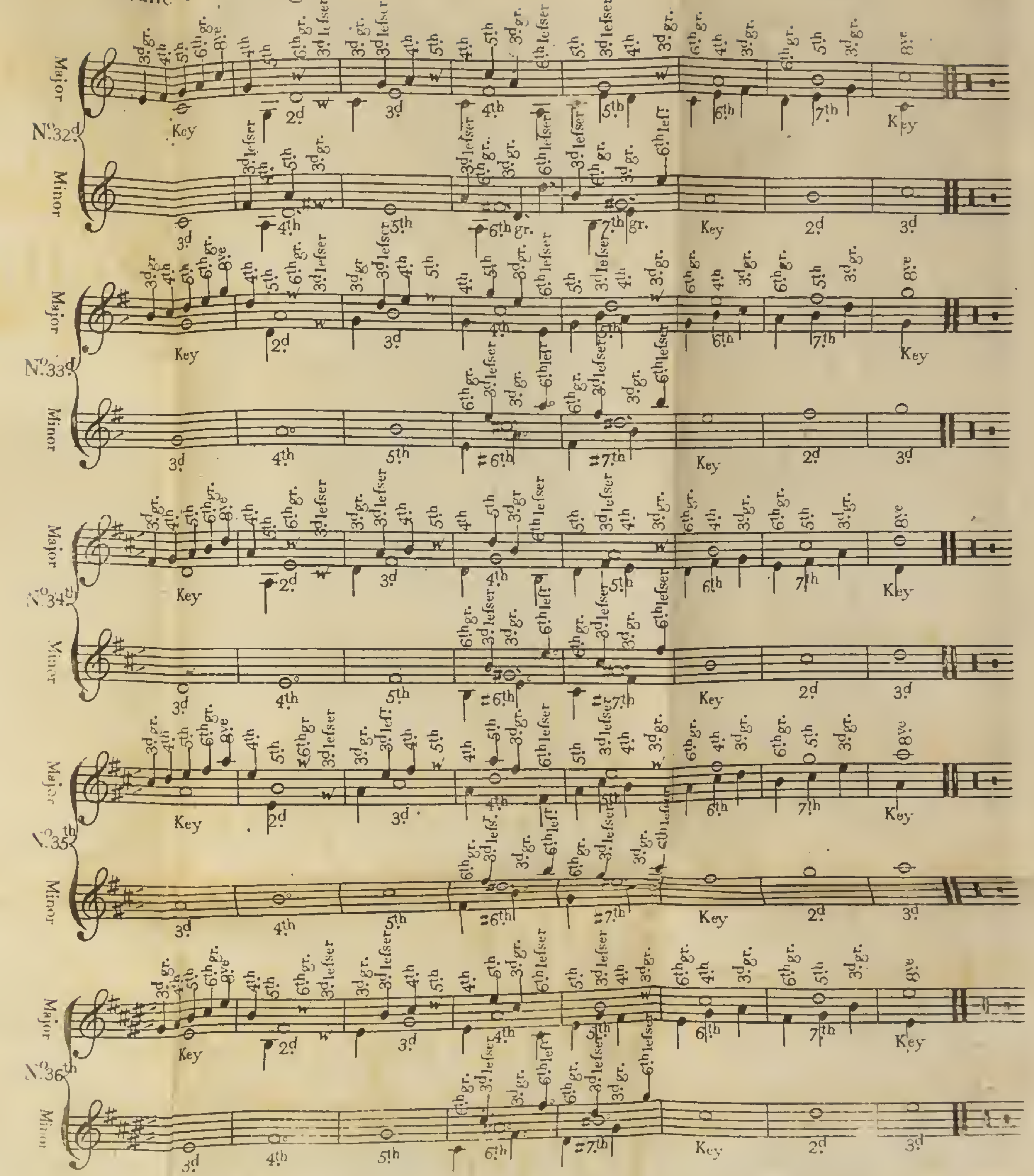
Page 47. laſt line, for *the* read *a*.
—— 55. l. 15. after *major* dele *or*.
—— 76. l. 15. add the grave mark to ※C at the end of the line.
—— 104. l. 9. for 37 read 32.
—— 107. l. 4. add the acute mark to E.
—— 109. l. 8. after *firſt* add *ſtring*.
—— 139. l. 14. dele the comma after *perfectly*.
—— 157. l. 22. of the table of affinities, after 4*th* dele *leſſer*.
—— 174. l. 16. add a ſharp mark to F.
—— 177. l. 11. add a grave mark to ♭₵.E
—— 187. l. 17. for ※G′ read ※G‵.
—— 194. col. 5th of the table, oppoſite to the finger-key ✠F or G, for $\frac{2048}{3025}$ read $\frac{2048}{2025}$.
—— ibid. col. 4. l. 9. from bottom, for 3 2 1 read 2 2 1.
—— ibid. col. 2. l. 7. from bot. add the acute mark to ※A.
—— 197. l. 9. for ※F° read ✠F°.
—— 199. l. 13. dele *may*.
—— 208. l. 13. put a comma after *interval*.
—— 211. l. 17. for *judge* read *reſource*.
—— 223. l. 4. dele *from*.
—— 226. l. 4. after *of* add *affording it in*.
—— 229. l. 16. dele *&c.*
—— 231. l. 6. for *ingenious* read *ingenuous*.
—— 234. l. 2. dele *more*.
—— 245. l. 9. for *muſt* read *may*.
—— 250. l. 8. dele *beſides*.

DIRECTIONS to the BOOKBINDER.

The firſt *Eight* PLATES to be inſerted between p. 152 and p. 153, and the remainder to be placed at the end of the book. They muſt not be ſtitched with guards, but ſewed together over the backs, and made to fold out to the right.

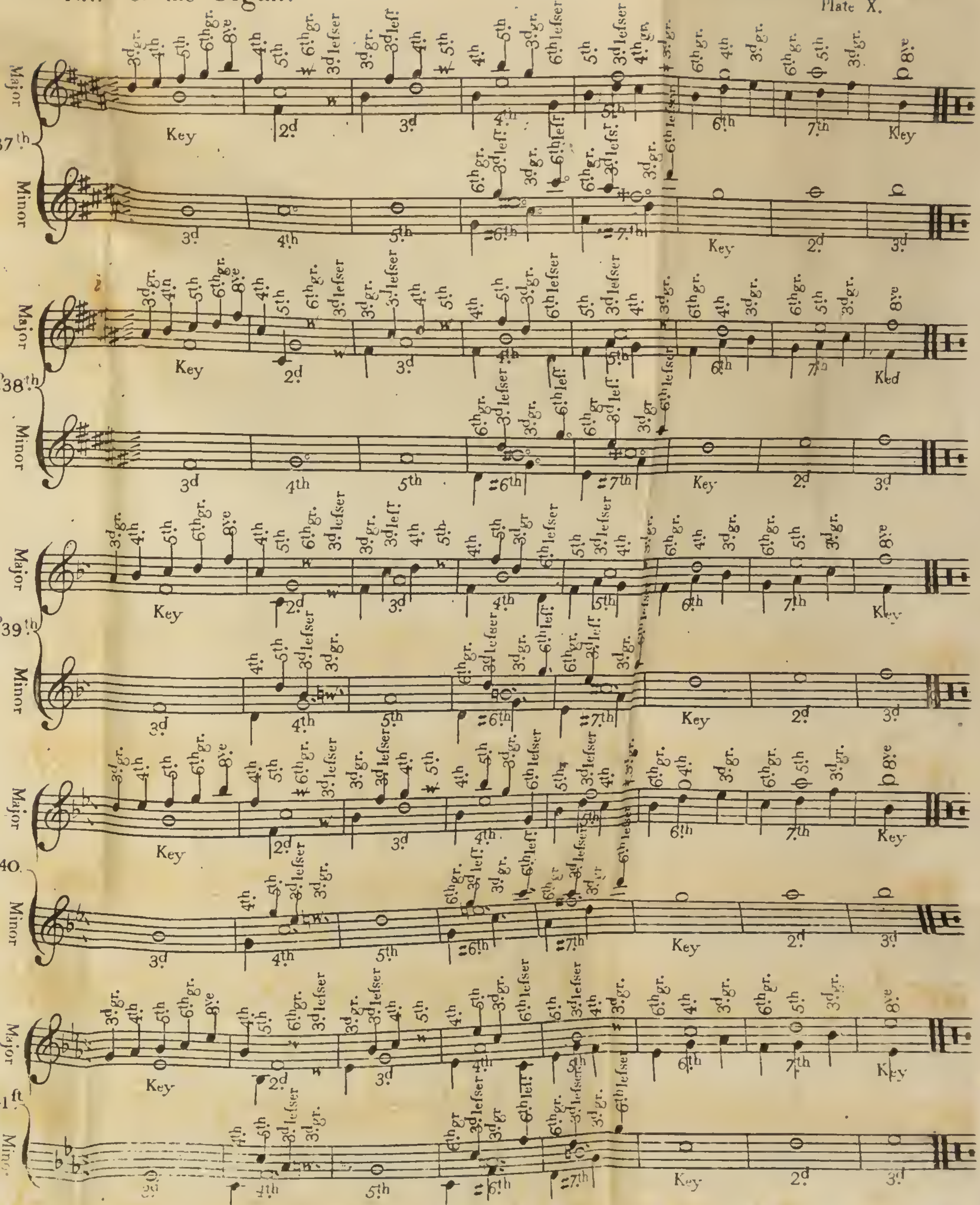
Tune of the Organ.

Plate IX.


No. 32d
Major
3d gr. 4th 5th 6th gr. 8ve 4th 5th 6th gr. 3d lesser 3d gr. 3d lesser 4th 5th 4th 5th 3d gr. 6th lesser 5th 3d lesser 4th 3d gr. 6th gr. 4th 3d gr. 6th gr. 5th 3d gr. 8ve
Key 2d 3d 4th 5th 6th 7th Key
3d lesser 4th 5th 3d gr. 3d lesser 6th gr. 3d gr. 6th lesser 3d lesser 6th gr. 3d gr. 6th lesser
Minor
3d 4th 5th 6th gr. 7th gr. Key 2d 3d
No. 33d
Major
3d gr. 4th 5th 6th gr. 8ve 4th 5th 6th gr. 3d lesser 3d gr. 3d lesser 4th 5th 4th 5th 3d gr. 6th lesser 5th 3d lesser 4th 3d gr. 6th gr. 4th 3d gr. 6th gr. 5th 3d gr. 8ve
Key 2d 3d 4th 5th 6th 7th Key
6th gr. 3d lesser 3d gr. 6th less 6th gr. 3d lesser 3d gr. 6th lesser
Minor
3d 4th 5th 6th 7th Key 2d 3d
No. 34th
Major
3d gr. 4th 5th 6th gr. 8ve 4th 5th 6th gr. 3d lesser 3d gr. 3d lesser 4th 5th 4th 5th 3d gr. 6th lesser 5th 3d lesser 4th 3d gr. 6th gr. 4th 3d gr. 6th gr. 5th 3d gr. 8ve
Key 2d 3d 4th 5th 6th 7th Key
6th gr. 3d lesser 3d gr. 6th less 6th gr. 3d lesser 3d gr. 6th lesser
Minor
3d 4th 5th 6th 7th Key 2d 3d
No. 35th
Major
3d gr. 4th 5th 6th gr. 8ve 4th 5th 6th gr. 3d lesser 3d gr. 3d less 4th 5th 4th 5th 3d gr. 6th lesser 5th 3d lesser 4th 3d gr. 6th gr. 4th 3d gr. 6th gr. 5th 3d gr. 8ve
Key 2d 3d 4th 5th 6th 7th Key
6th gr. 3d less 3d gr. 6th less 6th gr. 3d lesser 3d gr. 6th lesser
Minor
3d 4th 5th 6th 7th Key 2d 3d
No. 36th
Major
3d gr. 4th 5th 6th gr. 8ve 4th 5th 6th gr. 3d lesser 3d gr. 3d lesser 4th 5th 4th 5th 3d gr. 6th lesser 5th 3d lesser 4th 3d gr. 6th gr. 4th 3d gr. 6th gr. 5th 3d gr. 8ve
Key 2d 3d 4th 5th 6th 7th Key
6th gr. 3d lesser 3d gr. 6th less 6th gr. 3d lesser 3d gr. 6th lesser
Minor
3d 4th 5th 6th 7th Key 2d 3d

Tune of the Organ.

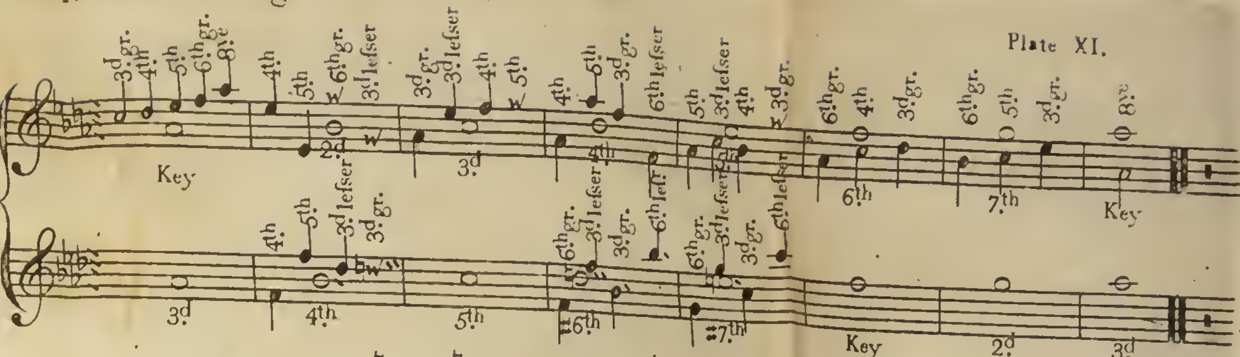
Plate X.



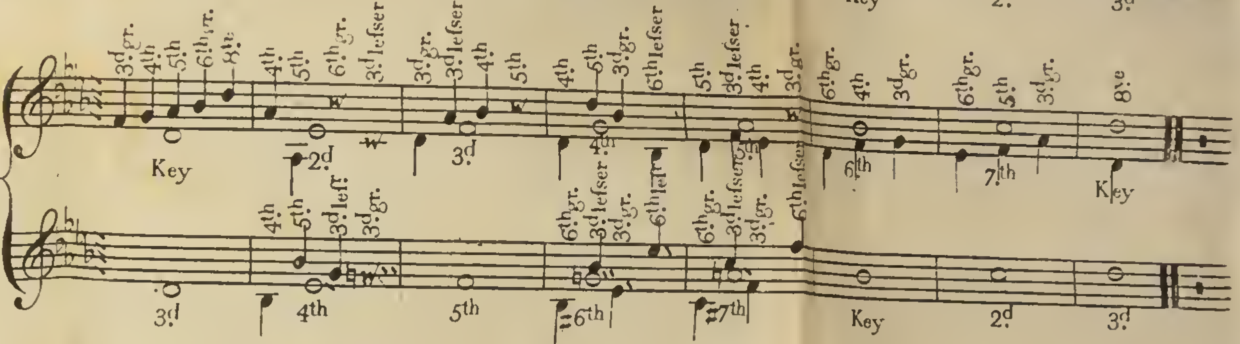
Tune of the Organ

Plate XI.

No. 42

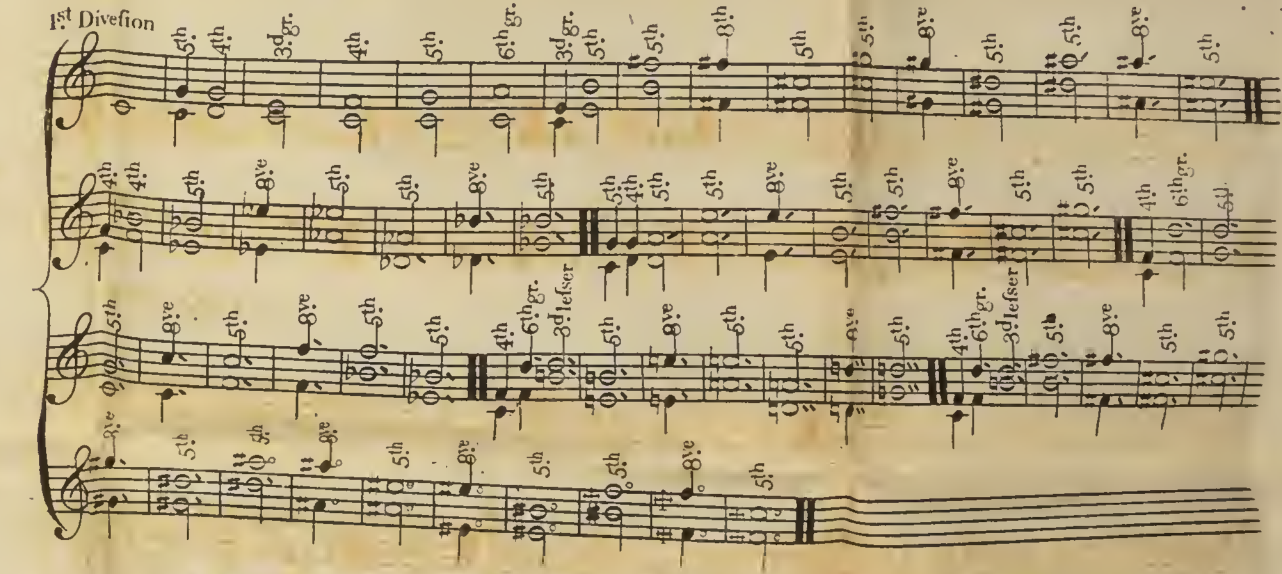


No. 43



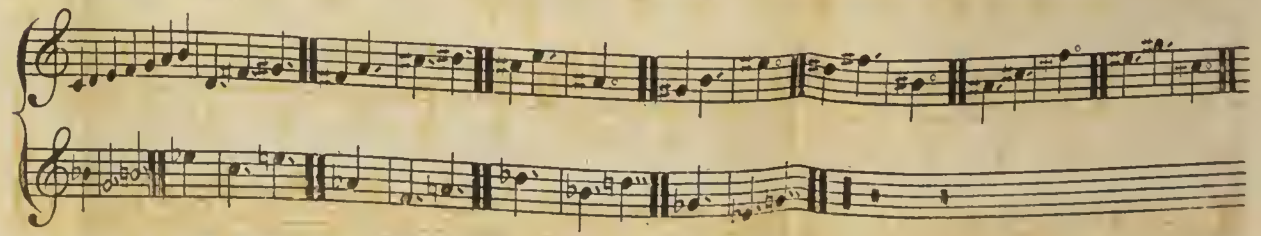
Tuning Scale No. 44

No. 44

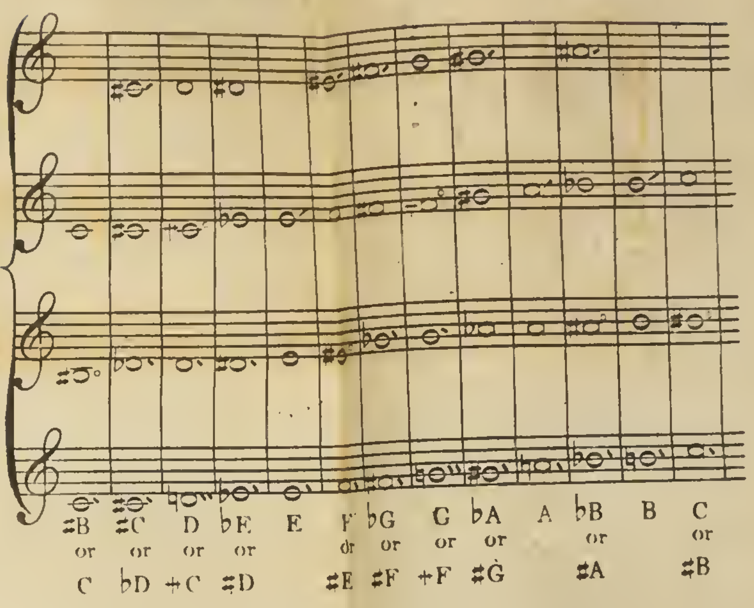


Scale No. 45

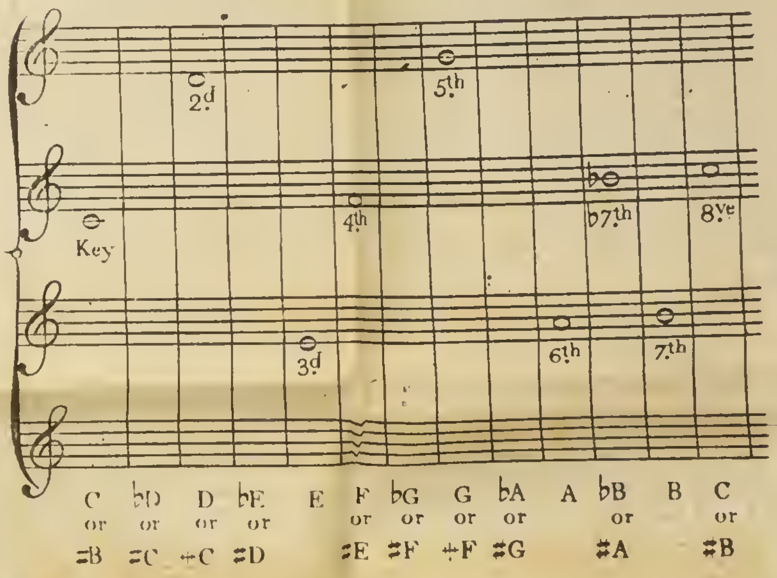
No. 45



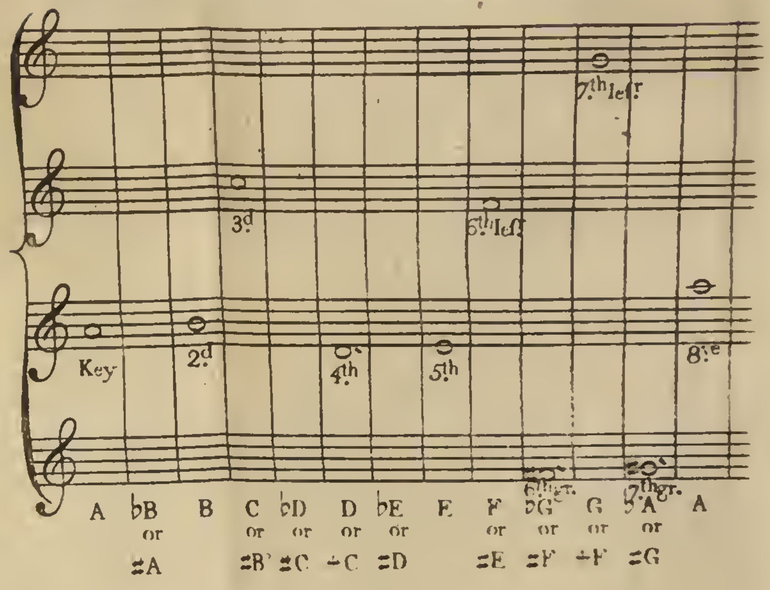
General arrangement of tune for the Organ
Scale Nº 46



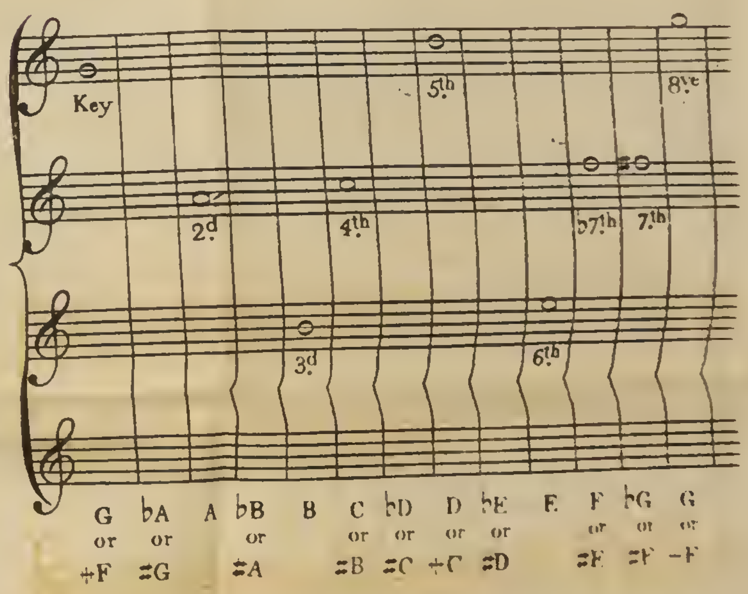
Particular arrangement of tune for the Organ
Key major C natural. Scale Nº 47.



Particular arrangement of tune for the Organ
Key minor A natural. Scale Nº 48

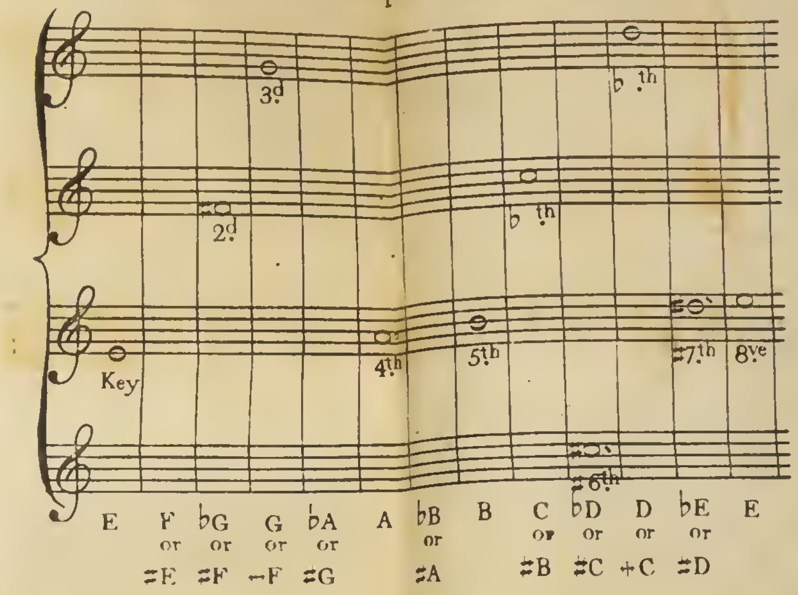


Key major G with one ſharp. Scale Nº 49



Particular arangement of Tune

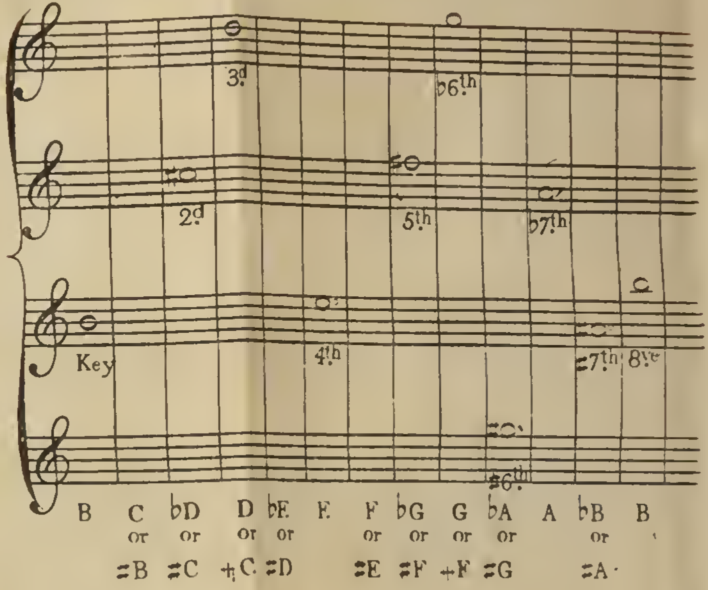
Key minor E with one Sharp. Scale No. 50.



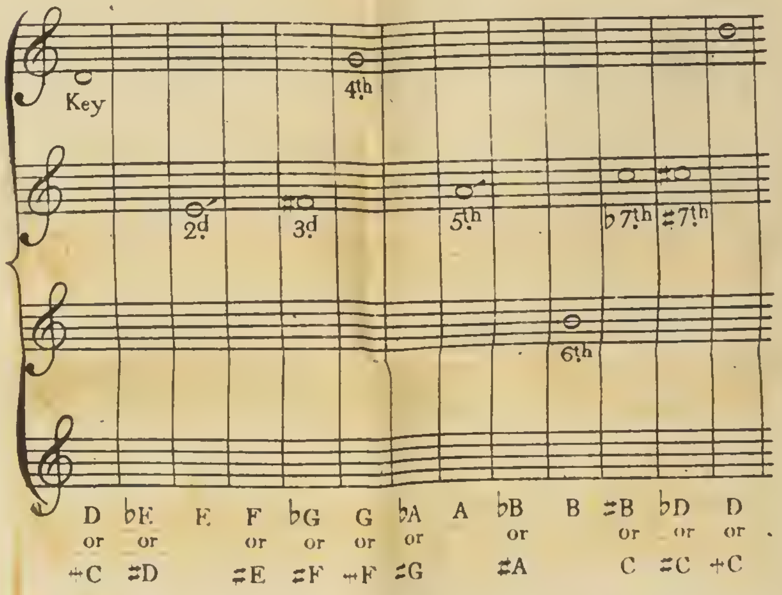
Particular arangement of Tune

Plate XIII

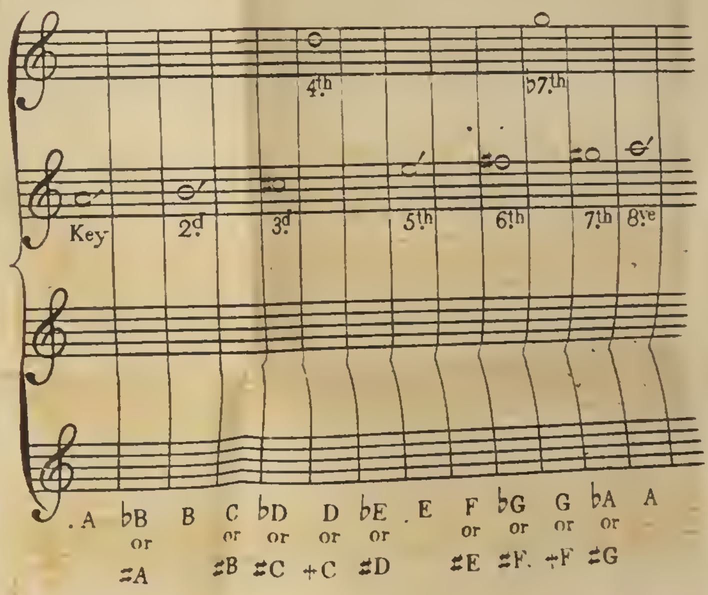
Key minor B with two ſharps. Scale No. 52.



Key major D with two ſharps. Scale No. 51

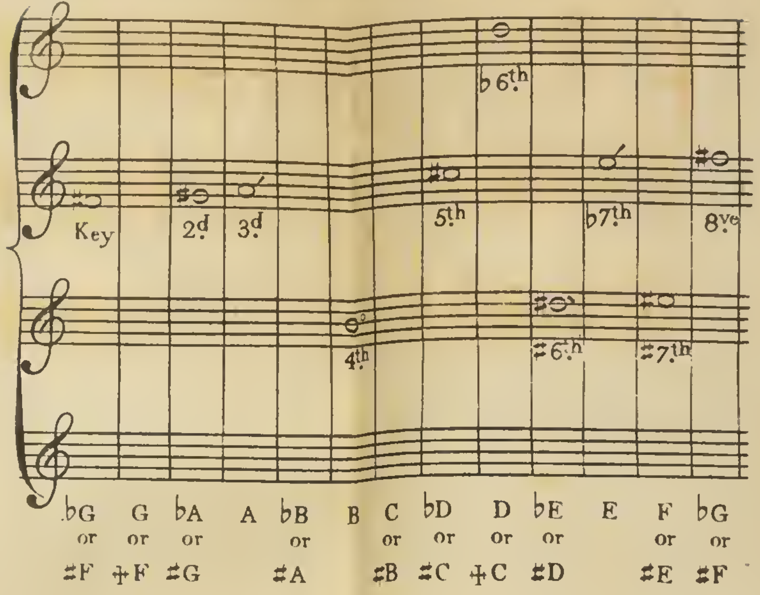


Key major A with three ſharps. Scale No. 53



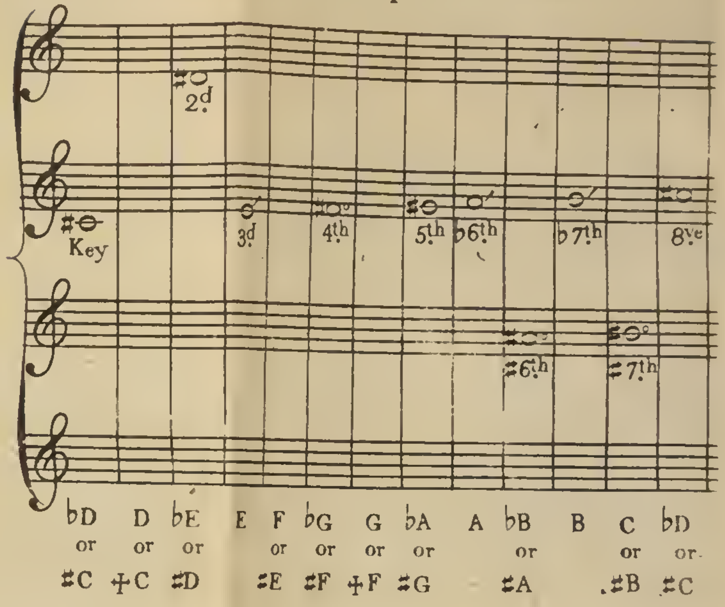
Particular arrangement of Tune.

Key minor ♯F with three Sharps. Scale N.º 54

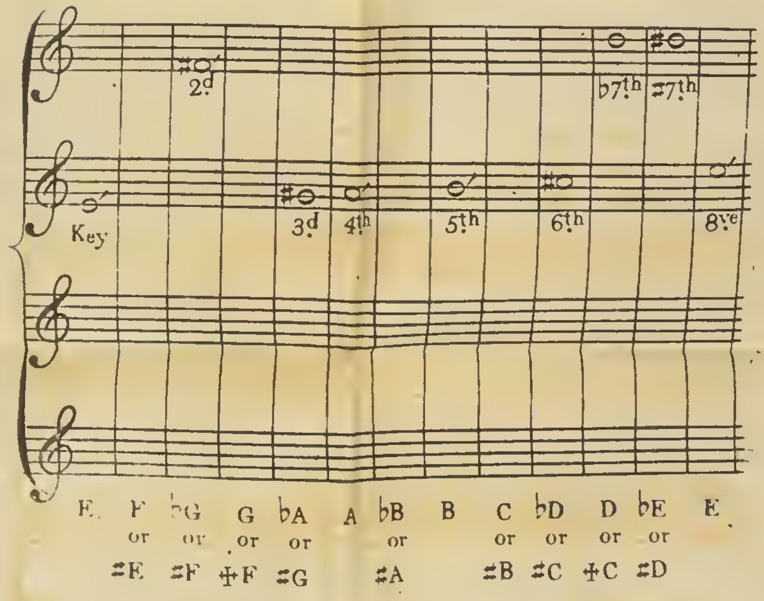


Particular arrangement of Tune

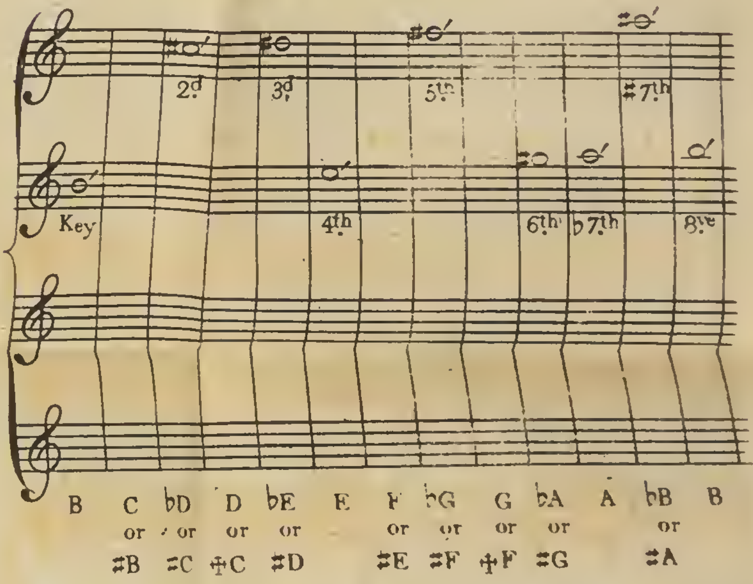
Key minor ♯C with four Sharps Scale N.º 56.



Key major E′ with four Sharps, Scale N.º 55

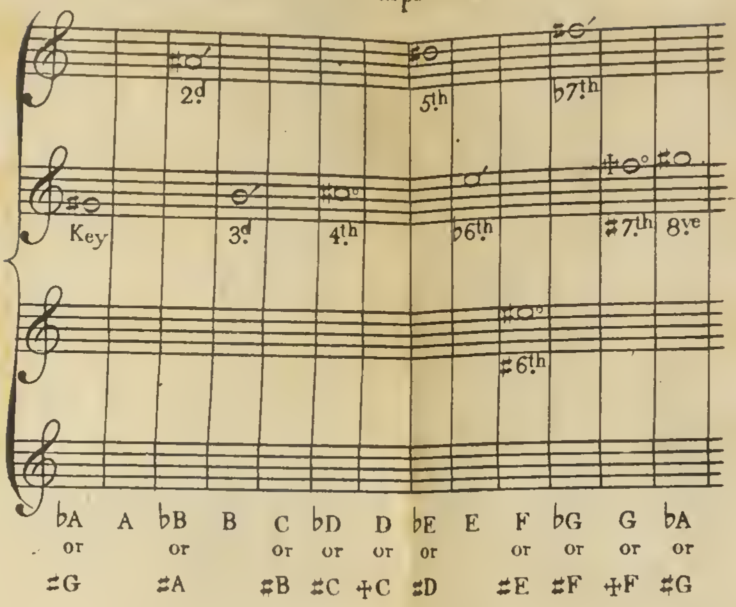


Key major B′ with five Sharps N.º 57

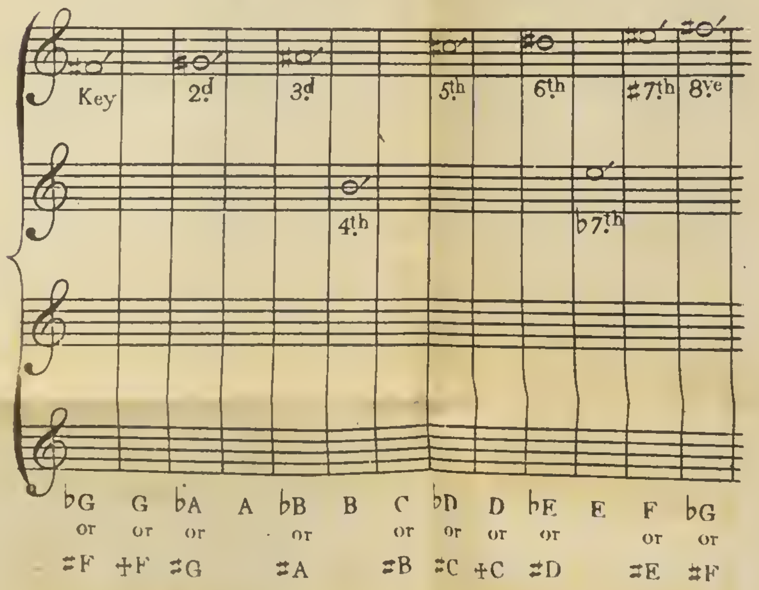


Particular arrangement of Tune

Key minor ♯G with five Sharps Scale No. 58

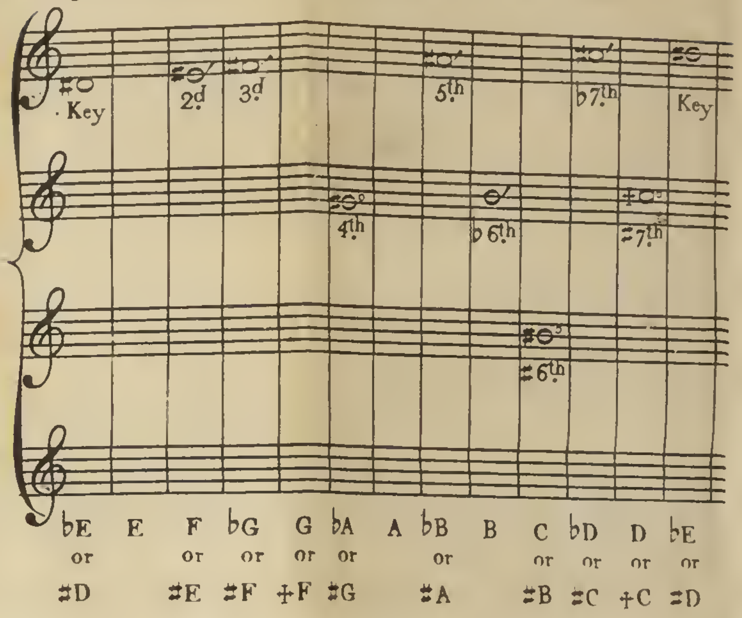


Key major ♯F with ſix Sharps. Scale No. 59

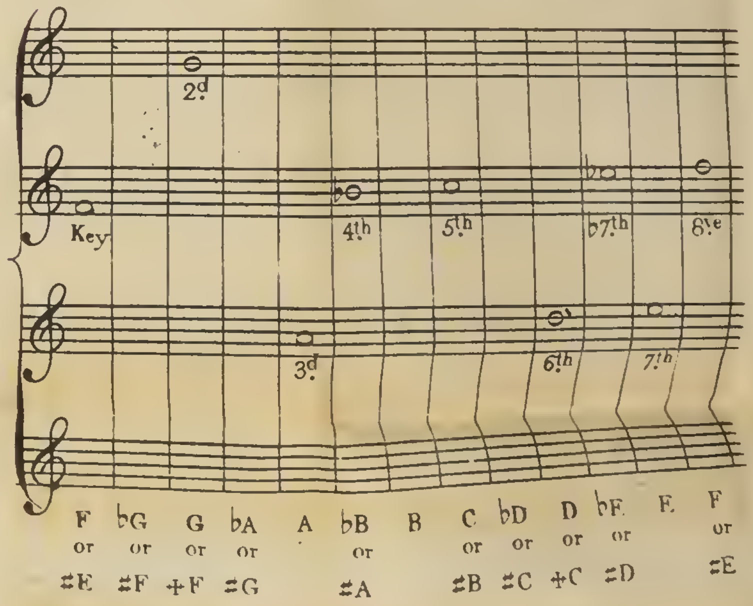


Particular arrangement of Tune Plate XV

Key minor ♯D with ſix Sharps Scale No. 60

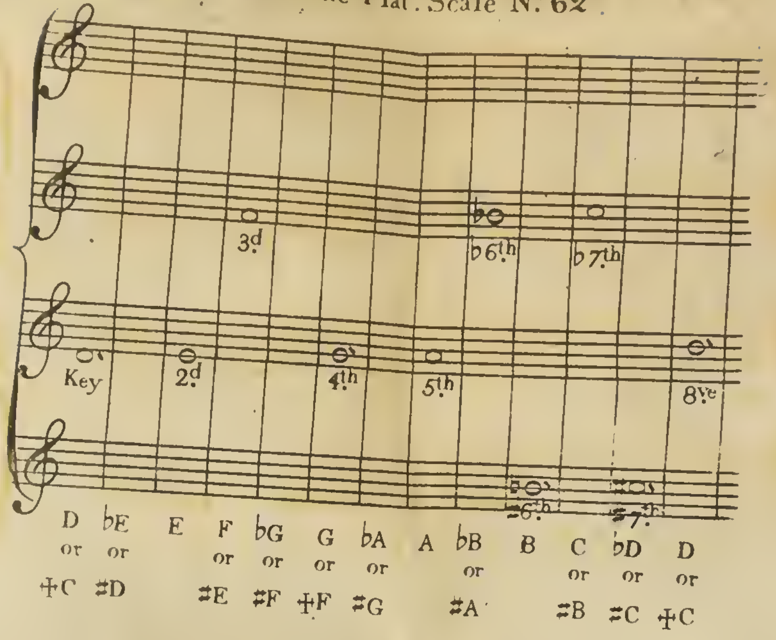


Key major F with one Flat. Scale No. 61

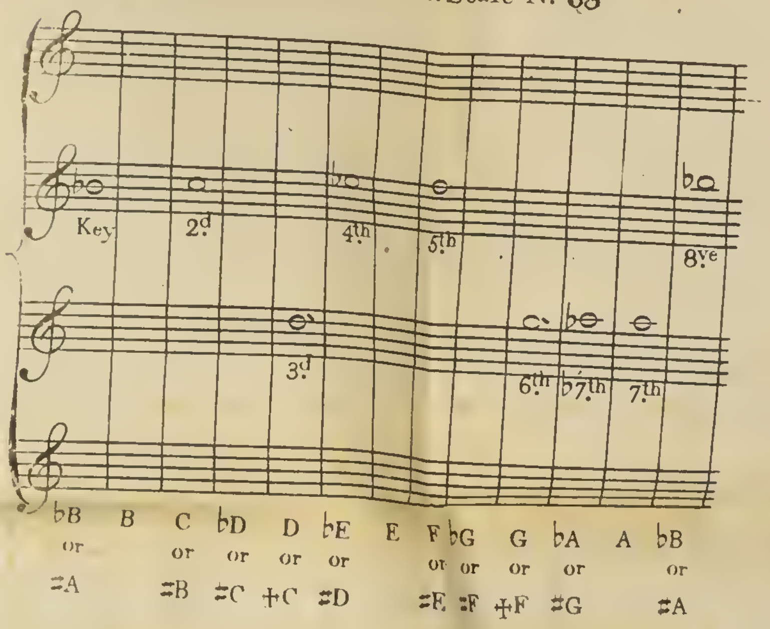


Particular arrangement of Tune

Key minor D' with one Flat. Scale No. 62.

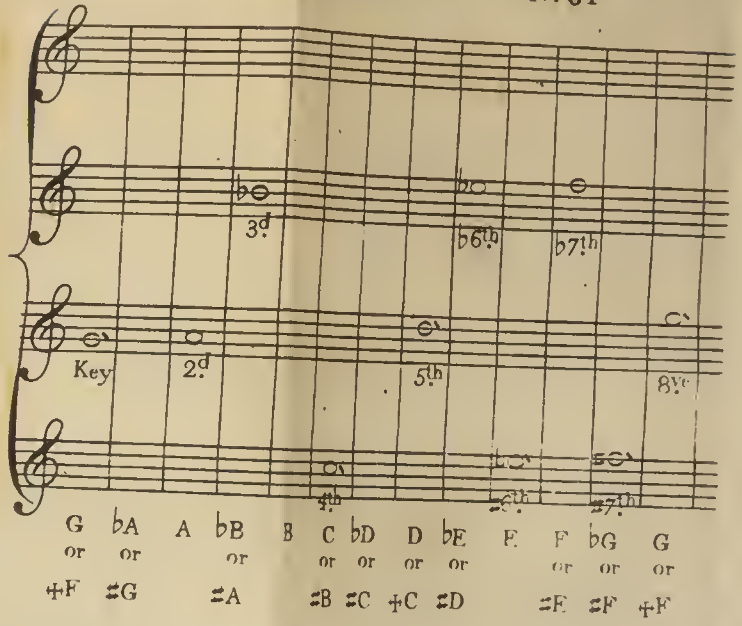


Key major ♭B with two Flats. Scale No. 63.

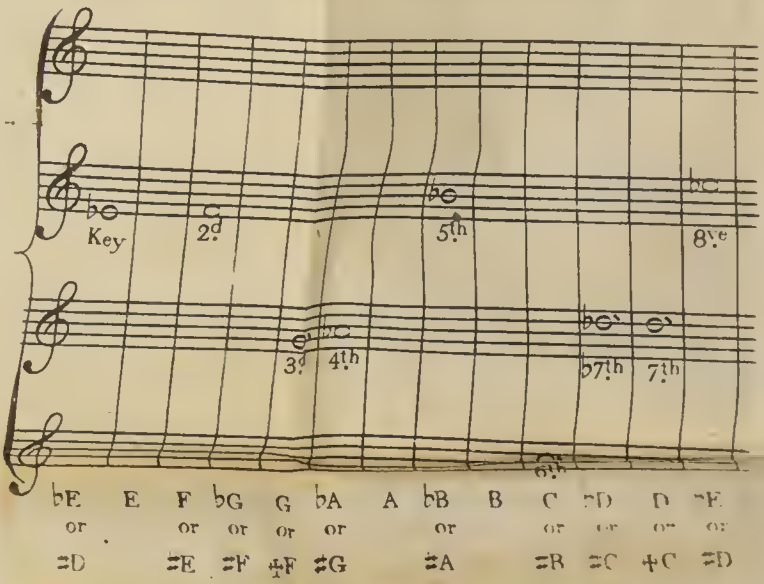


Particular arrangement of Tune. Plate XVI.

Key minor G' with two Flats. Scale No. 64

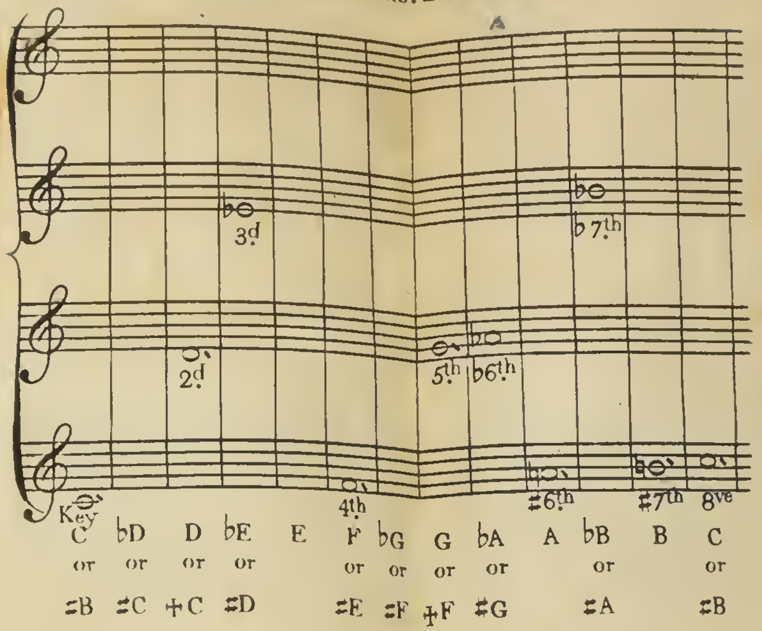


Key major ♭E with three Flats. Scale No. 65

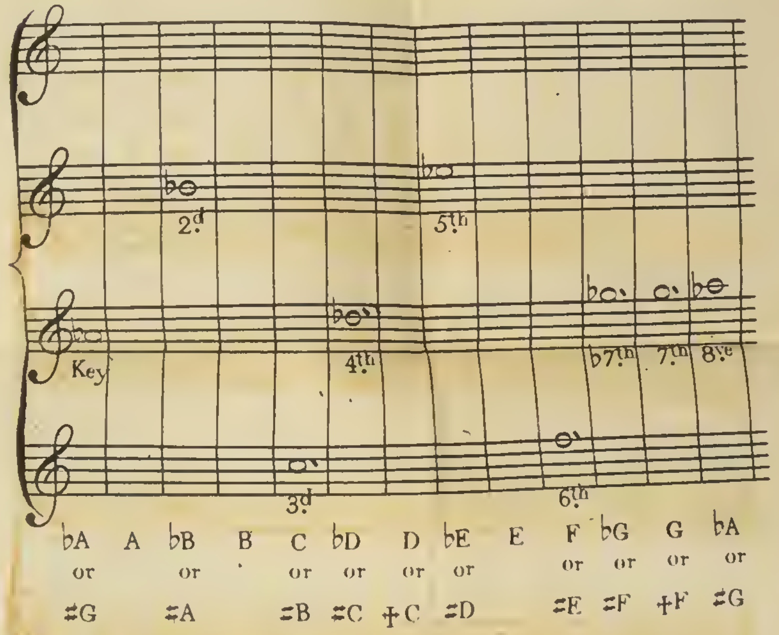


Particular arrangement of Tune

Key minor C with three Flats. Scale No. 66

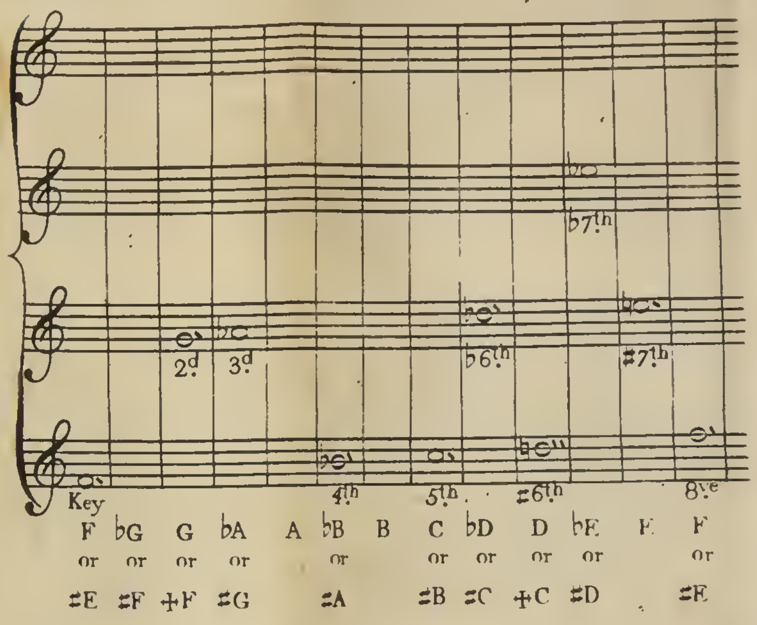


Key major ♭A with four Flats. Scale No. 67



Particular arrangement of Tune

Key minor F with four Flats Scale No. 68



Key major ♭D with five Flats. Scale No. 69

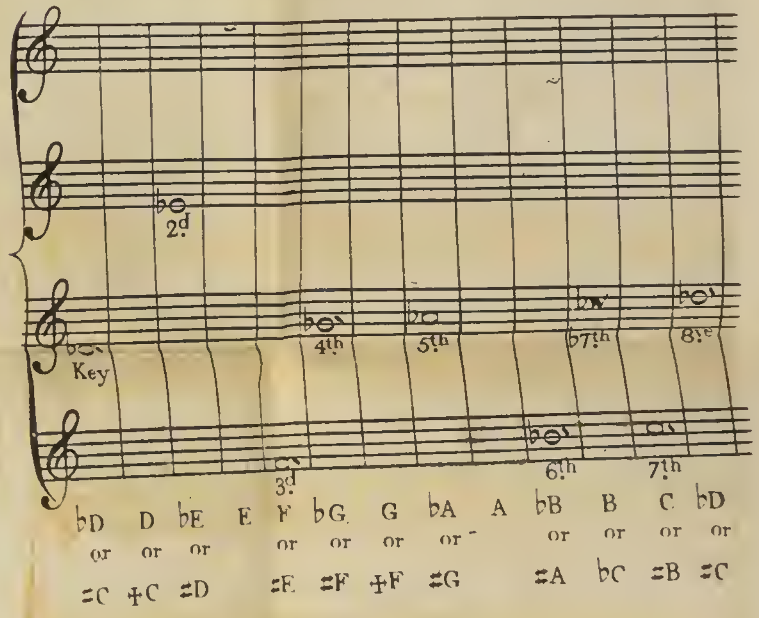
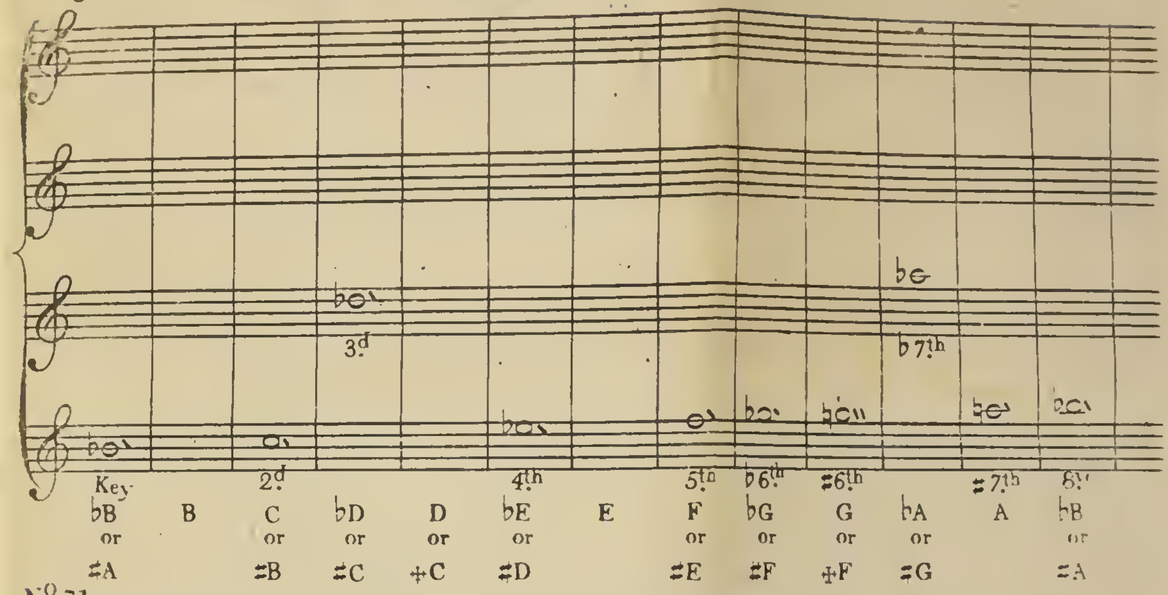


Plate XVIII.

Particular arrangement of Tune

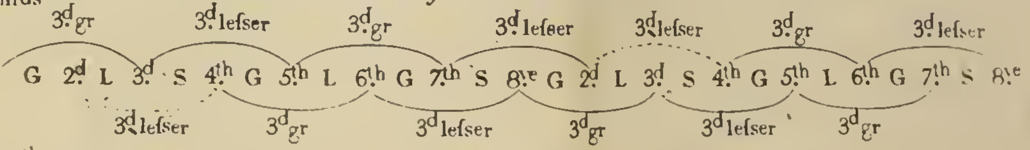
Key minor ♭B with five Flats. Scale No 70.



No 71.

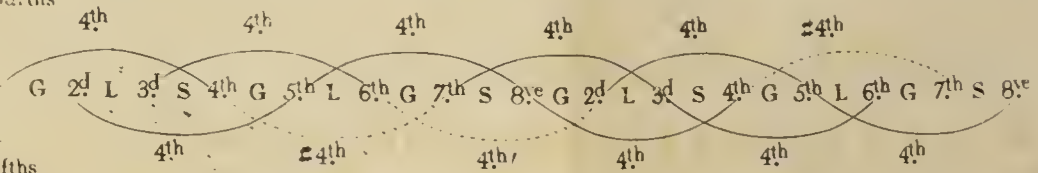
Order of the Chords as they ariſe in the Scale of Muſik.

Order of thirds
Figr 58th



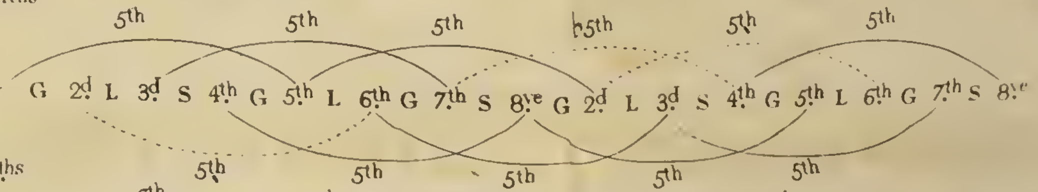
No 72.

Order of fourths
Figr 59th


4th
4th
4th
4th
4th
♯4th
Key G 2d L 3d S 4th G 5th L 6th G 7th S 8ve G 2d L 3d S 4th G 5th L 6th G 7th S 8ve
4th
♯4th
4th
4th
4th
4th

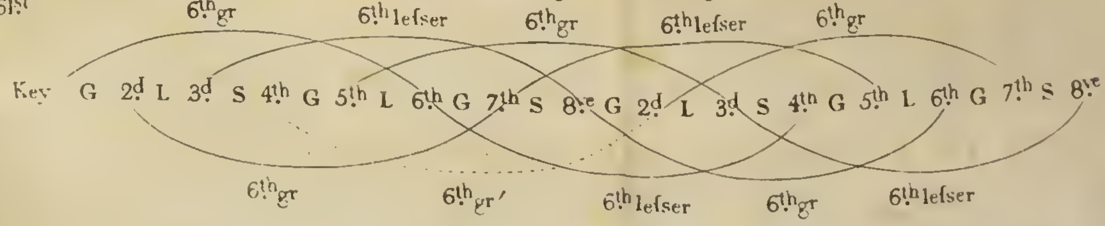
No 73.

Order of fifths
Figr 60th

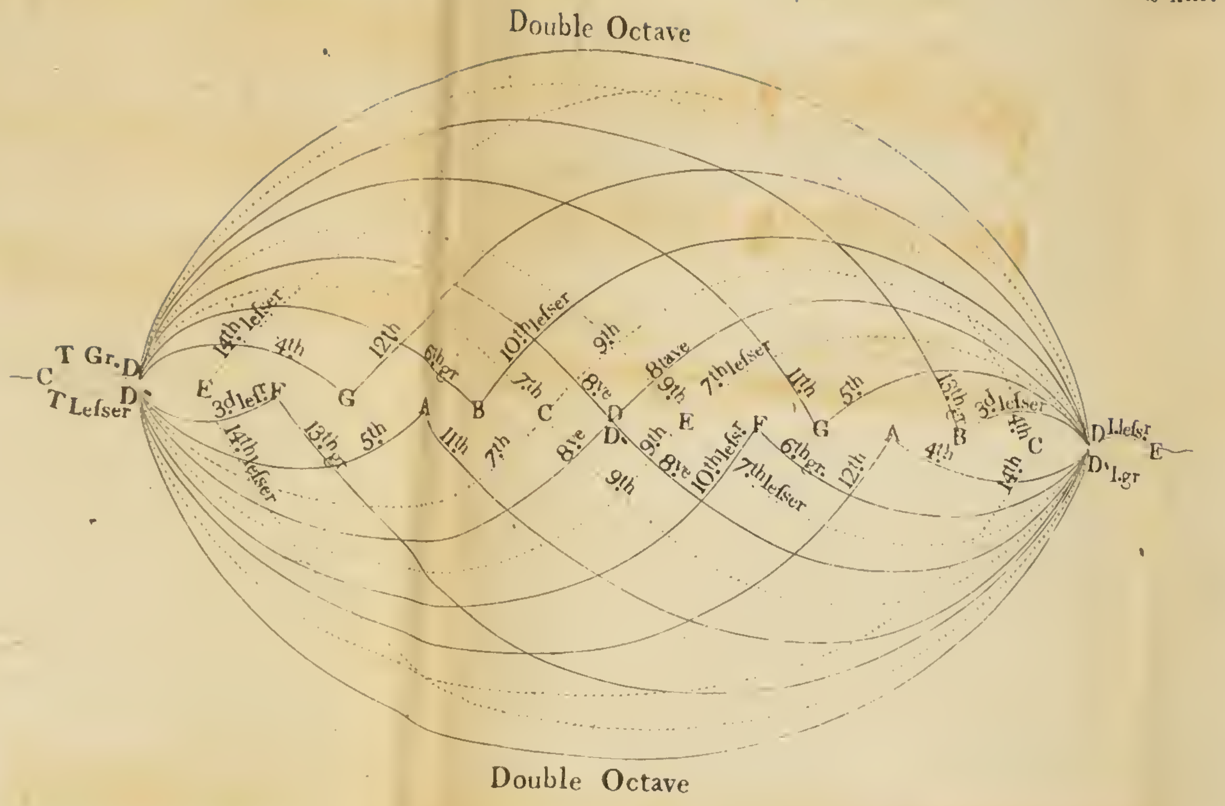

5th
5th
5th
♭5th
5th
5th
Key G 2d L 3d S 4th G 5th L 6th G 7th S 8ve G 2d L 3d S 4th G 5th L 6th G 7th S 8ve
5th
5th
5th
5th
5th

No 74.

Order of 6ths
Figr 61st


6th gr
6th leſser
6th gr
6th leſser
6th gr
Key G 2d L 3d S 4th G 5th L 6th G 7th S 8ve G 2d L 3d S 4th G 5th L 6th G 7th S 8ve
6th gr
6th gr
6th leſser
6th gr
6th leſser

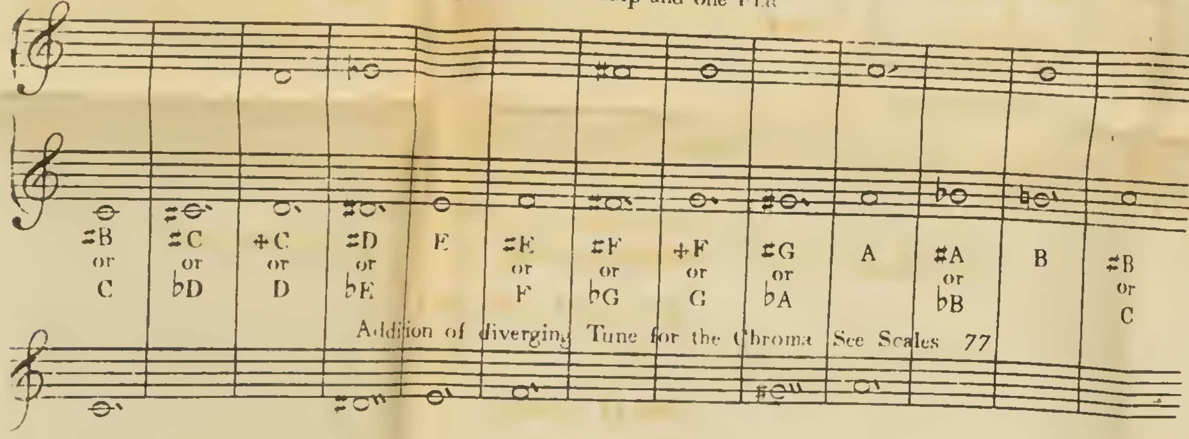
No. 75.



For the ORGAN

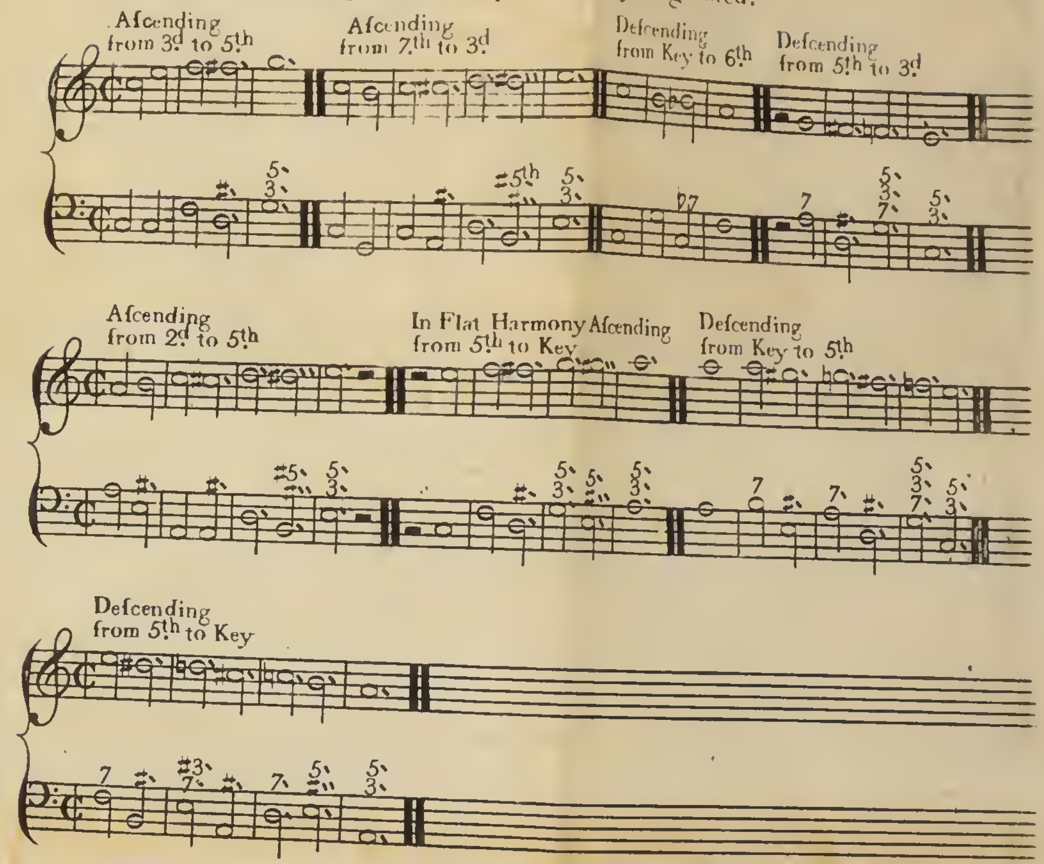
Arrangement of Tune for three contiguous ſignatures Scale 76.

Viz. the Natural one Sharp and one Flat

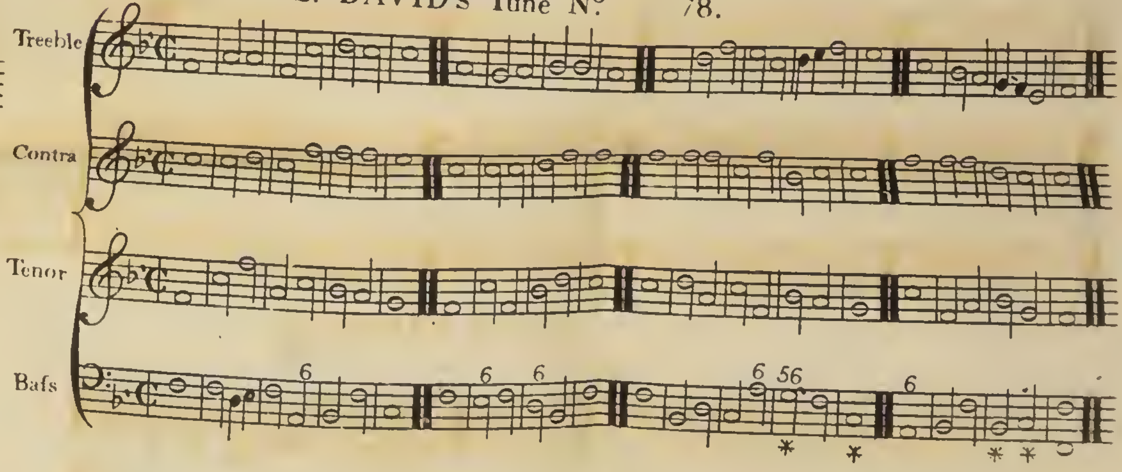


Scales No. 77

Chromalick Paſsages in ſharp Harmony Regulated.

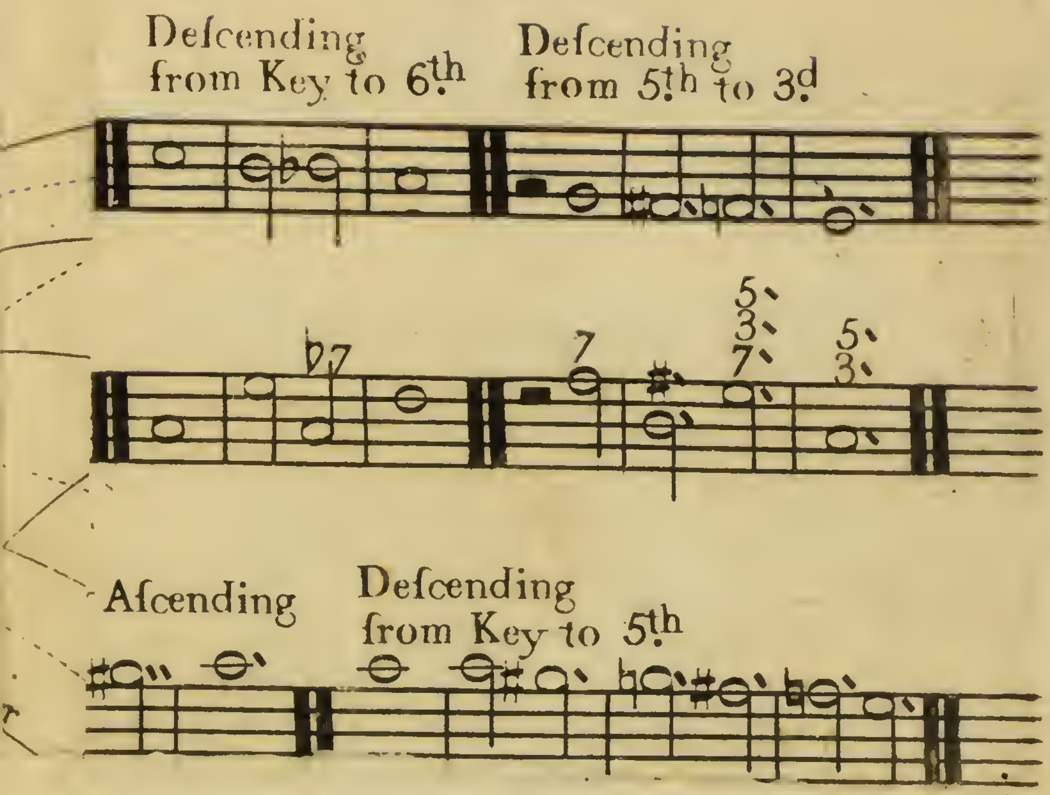

Aſcending from 3d to 5th
Aſcending from 7th to 3d
Deſcending from Key to 6th
Deſcending from 5th to 3d
Aſcending from 2d to 5th
In Flat Harmony Aſcending from 5th to Key
Deſcending from Key to 5th
Deſcending from 5th to Key

St DAVID's Tune No. 78.



Index of Tune F, G, A, ♭B, C, D` E, *G; *G, *G` *G°

ony Regulated.


Deſcending from Key to 6th
Deſcending from 5th to 3d
♭7
7
♯
5
3
7
5
3
Aſcending
Deſcending from Key to 5th

OEV